PLAN FOR MAJOR DRAINAGE

THE PIASA CREEK, WOOD RIVER, AND CAHOKIA CREEK PLANNING BASINS

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THE PIASA CREEK, WOOD RIVER, AND
CAHOKIA CREEK PLANNING BASINS

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ABSTRACT: The plans for major drainage for the Madison County portion of the Piasa Creek, Wood River, and Cahokia Creek Planning Basins, presented in this report, represent a continuation of the application of the Surface Drainage methodology to actual drainage basin problem situations. In documenting completion of the planning program in these second priority basins, the report describes all activities involved in the planning process, and records conclusions, information and data resulting from or generated by these activities. Included in the report are the basic data and analyses results utilized in the development of alternative plans for the major drainage systems in the planning area. Additional detailed information is presented in Appendices A through I.

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SURFACE DRAINAGE PLANNING PROGRAM

FOR

MADISON, ST. CLAIR, MONROE AND RANDOLPH COUNTIES, ILLINOIS

PLAN FOR MAJOR DRAINAGE

THE PIASA CREEK, WOOD RIVER, AND CAHOKIA CREEK PLANNING BASINS

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prepared by

Southwestern Illinois Metropolitan
and Regional Planning Commission

Collinsville, Illinois

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- Members of the Technical Advisory Committee comprised of: consultants from local and regional engineering and planning firms; and representatives of Environmental, Earth Science, and Planning Departments of Southern Illinois University, Edwardsville.

- Members of the Basin Advisory Committee, including the Mayors, Township Supervisors, and County Board Members representing the Madison County portion of the three-basin study area; and representatives of the Madison County Soil and Water Conservation District, and local Drainage and Levee Districts.

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INTRODUCTION

part one

CHAPTER 1
INTRODUCTION

CHAPTER 2
HISTORY OF FLOODING

1

INTRODUCTION

INTRODUCTION

Water management is an integral part of comprehensive regional planning developed to guide future development within the Southwestern Illinois Region. Recognition of the importance of the water environment including control of its quality and quantity, as well as measures to prevent damage from flooding, erosion and siltation, is a fairly recent local occurrence brought about by changes in public policy, changing concepts in planning and management techniques, continued urban expansion, and environmental concerns of the past decade.

The management of storm runoff and prevention of flood damage aspects of water management are especially important in planning for the future development of the Southwestern Illinois Region. Severe drainage and flooding problems and the resulting high annual rate of damages due to flooding associated with portions of this geographic area have created an urgent need for a major planning effort to alleviate these adverse conditions. Major factors contributing to the urgency of the situation include:

- The inadequacy of existing drainage facilities, administrative policies, and maintenance procedures;
- The nonexistence or inadequacy of regulatory controls which has permitted urban expansion to continue in areas historically associated with storm drainage and flooding problems, as well as increasing pressure to accelerate the pace of urbanization in these areas;
- The lack of workable solutions to resolve drainage and flooding problems, despite numerous planning efforts and large expenditures of public money by federal, state and local agencies;
- The unavailability of comprehensive drainage information necessary to solution development.

In 1972, the Southwestern Illinois Metropolitan and Regional Planning Commission (SIMAPC) provided the mechanism for a major storm drainage and flood damage control planning effort through initiation of the Surface Drainage Program for four counties within its planning area--Madison, St. Clair, Monroe and Randolph. With funding assistance from federal, state and local agencies, several studies--a survey of existing drainage data, a plan of study, and a proposed major drainage system plan for the first priority Planning Basin in the program--have been completed and documented.[1]

This report, which documents completion of the basin planning process in three of the five second priority drainage basins in the Surface Drainage Program planning area, includes proposed major drainage system plans for the Madison County portion of the Piasa Creek, the Wood River, and the Cahokia Creek Planning Basins.

THE SURFACE DRAINAGE PROGRAM

The goal of the Surface Drainage Program is to develop plans and implementation strategies for managing storm water runoff and basin drainage in the Southwestern Illinois region that can be applied to the solution of current drainage problems and the prevention of future problems.

Planning Area

The area of concern in the surface drainage planning program officially incorporates the area within the political boundaries of four Illinois counties located o the east bank of the Mississippi River--Madison, St. Clair, Monroe and Randolph Counties. Although the entire area drains ultimately to the Mississippi River, i is divided naturally into two major river basins--the Mississippi and Kaskaskia. For the purposes of the Surface Drainage Program, these major basins have been further subdivided into ten watersheds or Planning Basins which lie entirely or partially within the four-county area.

Planning Basin Schedule

Adoption of the drainage basin approach to surface drainage planning necessitated the development of a Planning Basin schedule as a guide for program completion. Basin scheduling was determined through a basin priority rating system in which each Planning Basin was assigned a first, second or third priority rating. In assigning priorities, the following criteria were considered:

- Areas with critical drainage and flooding problems in terms of high annual flood damage;
- Areas in which federal and state agencies are actively involved in related drainage and flood control projects;
- Urban and urbanizing areas.

The presence of all three criteria in the American Bottoms and Hillside Drainage Area (Planning Basin 4) accounted for its first priority rating. Drainage and flooding problems in this highly urbanized area are critical, and both the Corps f Engineers and the Illinois Division of Water Resources are currently active in drainage projects in the basin (Plate 1).

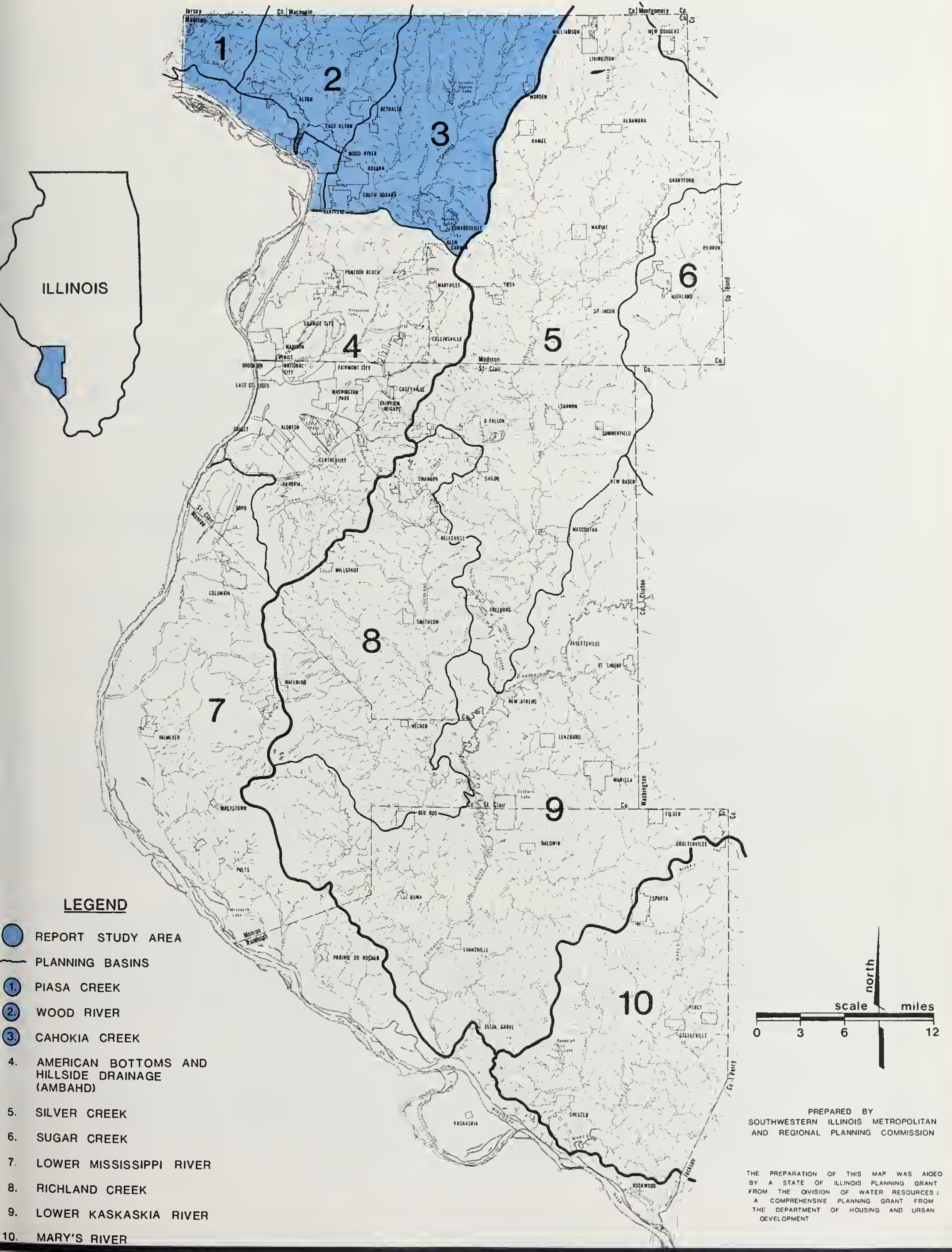
Five basins, Piasa Creek, the Wood River, and Cahokia, Silver and Richland Creeks (Planning Basins 1, 2, 3, 5 and 8), have been assigned a second-priority rating. Localized critical problem areas exist in these urban or urbanizing basins, and both the Corps of Engineers and the Illinois Division of Water Resources are currently active in several of the basins (Plate 1).

The remaining four basins, Sugar Creek, and the Lower Mississippi, Lower Kaskaski and Mary's Rivers (Planning Basins 6, 7, 9 and 10), have been assigned a third

PLATE 1

Planning Basins - Surface Drainage Program

MADISON, ST. CLAIR, MONROE, AND RANDOLPH COUNTIES, ILLINOIS



LEGEND

- ● REPORT STUDY AREA
- — PLANNING BASINS
- ① PIASA CREEK
- ② WOOD RIVER
- ③ CAHOKIA CREEK
- 4. AMERICAN BOTTOMS AND HILLSIDE DRAINAGE (AMBAHD)
- 5. SILVER CREEK
- 6. SUGAR CREEK
- 7. LOWER MISSISSIPPI RIVER
- 8. RICHLAND CREEK
- 9. LOWER KASKASKIA RIVER
- 10. MARY'S RIVER

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priority rating. Although localized problem areas can be found in these basins, and the Corps of Engineers is currently active in some portions of these basins, this area is generally rural in nature and current population growth projections call for little significant change in the immediate future (Plate 1).

Planning Program

Utilizing a drainage basin approach, the planning program provides for the establishment of regional drainage criteria; the systematic identification, analysis and definition of existing and potential storm drainage and flooding problems; alternative solution identification and selection; and major drainage plan development and implementation for each of the ten Planning Basins located within the planning area.

A major objective of the program was the development of a methodology for plannin the major drainage system within the basins, which could also be applied to planning and designing the secondary drainage systems when used in conjunction with other tools provided by the program--established drainage criteria and a description of the existing situation.

To properly utilize the surface drainage program methodology, it is essential to understand the concept of two drainage subsystems--the major drainage system and the secondary drainage system.

- The major drainage system consists of natural facilities--rivers, creeks, streams, sloughs, and flood plains; and man-made facilities--artificial channels, detention areas and pumps. This system, also referred to as the primary drainage system, collects, conveys and stores the runoff from major storms, generally considered the 100-year or 1 percent probability event. During these periods of increased runoff, the major drainage system will utilize all of its facilities, regardless of man's use of the land within or adjacent to these facilities. To avoid the human and economic disasters associated with overbank flooding and to assist in the prevention of local flooding, it is essential to adequately plan for and maintain the major drainage system, preserving and respecting nature's easement for major storm runoff.

  The major drainage system also functions as a backbone system for disposal of runoff from secondary systems. To assist in the prevention of local flooding, therefore, the system should provide sufficient capacity for the disposal of this additional runoff.

- The secondary drainage system refers to the storm drainage facilities used for collecting and conveying local storm runoff to disposal points in the major drainage system. This system, sometimes termed the storm sewer system, may include features ranging from curbs and gutters to storm sewer pipes, open drainageways and pumps. When planned to coordinate with the major drainage system; properly designed, operated and maintained, the secondary system can eliminate much of the irritation of local street and basement flooding.

Other major objectives addressed by the program include provisions for public involvement and inter-agency coordination in the planning process, and the generation of research to provide additional physiographic and hydrologic data necessary to effective drainage planning.

The program provides for public involvement and inter-agency coordination through several committees:

- The Environmental Agency Advisory Committee (formerly called the Steering and Coordinating Committee) provides input to the Surface Drainage Program and the areawide 208 Wastewater Management Planning Program, and promotes inter-agency coordination in related water resource management activities in the Southwestern Illinois planning area.
- The Basin Advisory Committees provide for local involvement in each Planning Basin. Members serving on these Committees represent governmental units, special districts, business interests, and residents of the individual Planning Basins.
- The Technical Advisory Committee provides technical input and additional local involvement in the program. Membership includes local agencies and institutions with expertise in planning, engineering, hydrology, and the environmental sciences.

Research activities, generated by the planning program, provide additional information concerning the physical and hydrologic character of the Planning Basins. Extension of the data base for the Planning Basins considered in this report has been accomplished through assistance and research activities of the Illinois Water Survey, the Illinois Geologic Survey, the Soil Conservation Service, and the Soil and Water Conservation District of Madison County.

Program Limitations

Many storm drainage and flooding problems defined within each Planning Basin are caused by local runoff and due to deficiencies in local (secondary) drainage facilities and regulations. Since the development of plans for secondary drainage systems is not included in this phase of the surface drainage planning program, the selected basin plans will not solve all local drainage problems.

Total project cost estimates considered in basin plan formulation and selection are based on generalized cost curves, developed specifically for the Surface Drainage

Program. The selected basin plans, therefore, are not intended to reflect optimization through formal cost-benefit procedures.

The role of the Corps of Engineers in the implementation of federally funded flood control projects must be particularly noted. Should the Corps be actively involved in a flood control project within a Planning Basin, the basin plan, selected through the surface drainage planning program for that particular basin, will be subject to the hydrologic and hydraulic analysis and design procedures of the Corps of Engineers, which may or may not result in its adoption as the Corps' plan recommended for implementation.

BASIN PLANNING REPORT

The drainage areas of Piasa Creek, the Wood River, and Cahokia Creek, which include portions of Jersey, Macoupin, Montgomery and Madison Counties, Illinois, are considered in this report. The area of primary concern includes the Madison County portion of each drainage basin, which collectively constitute the PIasa-WOod-CAhokia (PIWOCA) planning area. However, in order to provide total watershed consideration in the hydrologic and hydraulic procedures necessary to major drainage system plan formulation, the total drainage area of the three Planning Basins is included in the PIWOCA study area. (For study and planning area delineations and further explanation of the term PIWOCA, see Plate 2, and "Terminology" at the end of this chapter.)

In general, the PIWOCA (three-basin) study area, which includes approximately 337,000 acres, consists of rolling uplands with some steep bluff and lowland areas. The steep bluff areas terminate at the Mississippi River or rim its flood plain; the lowland areas include the flood plains of the major Planning Basins streams an the Mississippi River.

The PIWOCA planning area (Madison County) includes the lower portions of the three Planning Basins and two small drainage areas along the Mississippi River (Plate 2). Approximately 10 percent of the 178,000-acre planning area forms the northern portion of the American Bottoms--the Illinois flood plain of the Mississippi River which lies between Alton and the Cahokia Diversion Channel.

Piasa Creek, with a drainage area of only 14,000 acres within the PIWOCA planning area, drains the extreme northwest portion of Madison County. The headwaters of this stream, as well as its confluence with the Mississippi River, and a large portion of its 78,000-acre total drainage area are located in Jersey County (Plate 2). In general, this Planning Basin area includes rolling to broken uplands which terminate in steep bluffs at the river.

The Wood River, which traverses a portion of the American Bottoms, is formed by th junction of its two major tributaries--East and West Forks--at a point 2.2 miles above its confluence with the Mississippi River. About 2.8 miles of East Fork and 1.3 miles of West Fork are also located within the Mississippi flood plain. The Wood River has a total drainage area of approximately 80,600 acres, more than half of which lies within the PIWOCA planning area (Plate 2).

PLATE 2

PLANNING

PIASA CREEK

(PIWOCA)

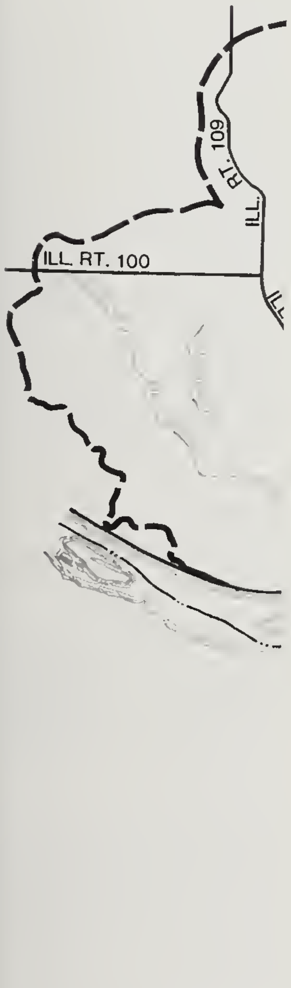

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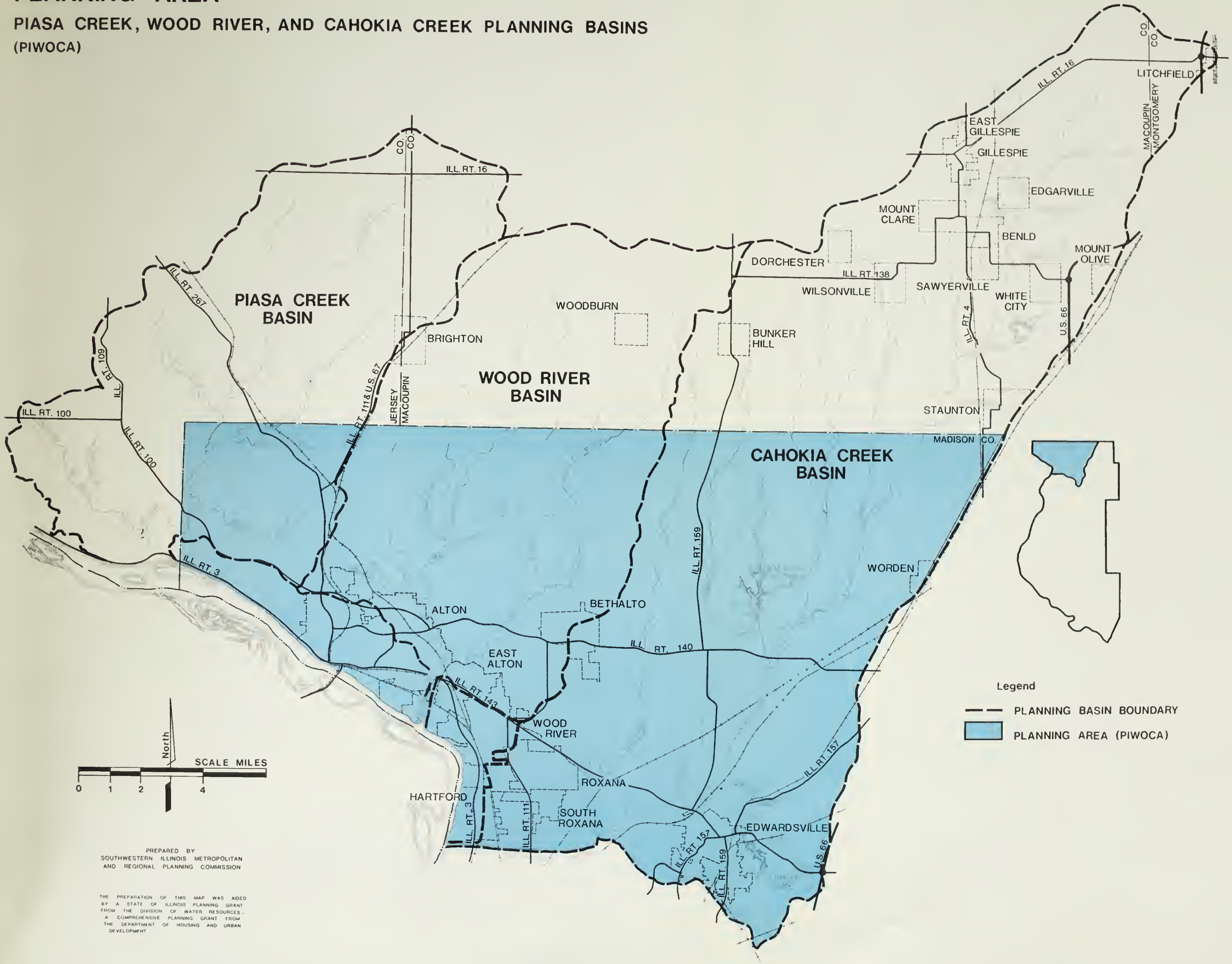
PLATE 2

PLANNING AREA

PIASA CREEK, WOOD RIVER, AND CAHOKIA CREEK PLANNING BASINS (PIWOCA)



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Cahokia Creek, with a total basin drainage area of approximately 178,000 acres, rises in Montgomery and Macoupin Counties and flows in a southwesterly direction some 48 miles to the American Bottoms where its flow and that of its major tributary, Indian Creek, are intercepted by the Cahokia Diversion Channel for transport to the Mississippi River. The basin extends from its headwaters in the Litchfield area near the Macoupin-Montgomery county boundary on the north, to the Cahokia Diversion Channel on the south, with the Wood River watershed divide as its western boundary and the major Mississippi-Kaskaskia drainage divide as its eastern boundary. The lower half of the Cahokia Creek Planning Basin lies within Madison County, and, therefore, within the PIWOCA planning area (Plate 2).

The Basin Plans

The plans for major drainage for the Madison County portion of the Piasa Creek, the Wood River, and the Cahokia Creek Planning Basins (the PIWOCA planning area), presented in this report, represent a continuation of the application of the Surface Drainage Program basin planning methodology to actual drainage basin problem situations. In documenting completion of the planning program in these second priority basins, the report describes all activities involved in the planning process, and records conclusions, information and data resulting from or generated by these activities. Although the planning program stops short of facility design, major elements of the selected major drainage system plans are defined with enough detail to provide local officials with a feasible plan for a major drainage system capable of collecting and conveying major storm runoff (the 100-year storm). The plan will also provide local officials with a working document for guiding and controlling development within the basins.

Organization of Report

Organization of report material was guided by the planning elements of the Surface Drainage Program--problem definition, plan formulation, and implementation strategy. Introductory material and information concerning these major planning activities are followed by seven appendices.

Due to the homogeneity of the physical and hydrologic character of the three Planning Basins, the descriptive material presented in Parts One and Two deals with the three-basin area as one unit (the PIWOCA study area). In Part Three (planning and implementation), however, each Planning Basin is dealt with individually,

The appendices include relevant information concerning engineering procedures and plan formulation; alternative solutions considered; legal and administrative factors; and suggested ordinances for the prevention of damages due to flooding, high ground water table, and erosion and sedimentation. The Illinois Division of Water Resources' Wood River-East Alton Drainage Plan, and detailed information resulting from research projects generated by the study are also included in the appendices.

Terminology

Specific definitions have been assigned to certain titles and/or terms used throughout this report. These major terms are explained below.

PIWOCA is a term initiated for use in this report; it was derived from the names of the three streams and their drainage areas, which are considered in the report: PIasa Creek, the WOod River, and CAhokia Creek.

PIWOCA Study Area includes the total drainage area of the three-Planning-Basin area, which lies in portions of Jersey, Macoupin, Montgomery and Madison Counties, Illinois.

PIWOCA Planning Area is the Madison County portion of the three-Planning-Basin area which lies within the SIMAPC planning area.

American Bottoms is a familiar term for the flood plain of the Mississippi River in the Southwestern Illinois Region. In this report, it designates the southwestern portion of the PIWOCA planning area which lies between the Mississippi River and the bluff area and extends from Alton to the Cahokia Diversion Channel.

Synonyms used in this report: lowlands; flood plain; bottoms; alluvial plain.

Bluff area delimits the rugged upland area which rises abruptly above the American Bottoms. Within the PIWOCA planning area, this area of deep loess forms an arc which begins at the Mississippi River near Alton and extends southeastward to the Cahokia Diversion Channel.

Synonyms used in this report: upland area; eastern uplands; tributary upland area.

* * * * *

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[1] Southwestern Illinois Metropolitan and Regional Planning Commission, *Background Survey;* and *Study Design* (Collinsville, Illinois: 1973); and *Plan for Major Drainage: The American Bottoms and Hillside Drainage Area Planning Basin* (Collinsville, Illinois: 1975).

HISTORY OF FLOODING

2

HISTORY OF FLOODING PROBLEMS

he most severe problems due to riverine flooding and/or internal flooding within
he Piasa Creek, the Wood River, and the Cahokia Creek Planning Basins have histor-
cally been associated with the flood plains of major streams within or adjacent
o the three-basin area. Today the most critical problem areas are located in the
merican Bottoms, the Illinois flood plain of the Mississippi River which extends
rom the City of Alton to the Cahokia Diversion Channel in Madison County.

an has occupied the American Bottoms portion of the PIWOCA planning area for more
han 1,000 years. The period of settlement extends from early aboriginal villages,
hrough European settlement during the 18th Century, to later occupance by Americans
f European and African descent. Permanent settlement began in the early 1800's
ith the establishment of villages or hamlets including Alton, Upper Alton, Milton,
dwardsville and Wood River. By 1812 Madison County had attained a population of
bout 1,000, most of which was located in the PIWOCA planning area. During this
arly period of settlement, economic activity was concerned primarily with sub-
istence agricultural and limited trade functions. By mid-century, the area had
ecome a major center for river traffic (Alton) as well as a significant agricul-
ural producer with markets in nearby St. Louis.

he decline in steamboat traffic during the latter part of the century coincided
ith the expansion of railroad systems which marked the beginning of modern indus-
rial expansion. In the planning area, this rail advantage and other economic ad-
antages, such as coal deposits in the adjacent upland areas; plentiful ground
ater supply, and the elevated level land of the Wood River Terrace in the Bottoms
ttracted industry to that area and, in particular, contributed to the growth of
etroleum refinery operations. As a result, by 1919 a major industrial complex
ncluding petroleum, ordnance and associated activities, steel, paperboard and
lass industries had been established in the PIWOCA planning area.

e rate and pattern of urban growth coincided with industrial development. In the
erican Bottoms, three company towns were built on the elevated sands of the Wood
iver Terrace before construction of the levees along the Mississippi River: East
ton (Olin Industries),Wood River (Standard Oil of Indiana), and Roxana (Shell Oil
mpany). The population of the PIWOCA planning area rose from approximately 15,000
1870 to 70,000 in 1930--an increase of 6.1 percent per year over the 60-year
eriod. Today this portion of Madison County is an important part of the Metro-East
rea, which is the second most populous region in the State of Illinois, and the
rgest industrial and population concentration on the Mississippi flood plain north
New Orleans.

ince the earliest settlement in the American Bottoms, the inhabitants have had to
ive with the constant threat of flooding. The early settlers respected the ease-
ent rights of the river and, therefore, learned to live with the flood plain en-
ironment; modern man, with his technology and large capital investment on the flood
ain, has attempted to control it.

RIVERINE FLOODING

Periodic inundation is a recurrent theme in historical accounts of the American Bottoms. The history of floods on the Mississippi River extends from the flood o 1724 recorded in the archives of the old capital of Kaskaskia to the "Great Flood occurring in 1973 in which the river reached an unprecedented stage of 43.23 feet at St. Louis. Overbank flooding and flood plain inundation were prevented durin the 1973 flood by the extensive system of levees, which were designed to contain river flood stages up to 52 feet at St. Louis. Therefore, although the 1973 even must be considered the flood of record in terms of river stage; in terms of inundation, the flood occurring in 1844 with the river cresting at 41.3 feet--11 feet above flood stage--remains the greatest flood of record.

Although numerous floods were recorded prior to 1900, it was not until the advent of extensive cultivation and urbanization in the American Bottoms at the turn of the century, that the human and economic disasters associated with floods were recognized as severe problems in need of resolution. The creation or formation o several flood control districts during the early 1900's, including the Wood River Drainage and Levee District in the PIWOCA planning area, marked the beginning of local efforts to alleviate flooding within the American Bottoms.

The flood of 1927, which crested at 36.1 feet at St. Louis, awakened national interest in the need for flood control, and prompted the Congress to pass the Feder Flood Control Act of 1928. As a result of this legislation and later Congressio actions, the federal government, through the U.S. Army Corps of Engineers, has ma tained an extensive flood control program on the Mississippi River.

Today high river stages no longer cause direct flooding in the American Bottoms. An extensive system of front and flank levees, constructed by the Corps of Engine and maintained by the organized flood control districts noted above, provide protection to the American Bottoms. The Wood River Drainage and Levee District leve provide protection against a 200-year frequency flood on the Mississippi River (river stage of 52 feet at St. Louis). However, it should be noted that the rive remains as an indirect cause of interior flooding when high river stages block t gravity flow of surface runoff for prolonged periods of time.

Direct flooding from the Mississippi River does occur within the PIWOCA planning area in the unprotected lowland areas north of the Wood River Drainage and Levee District boundary. Periodic inundation, in the Alton area particularly, disrupt urban activities and has caused extensive damages. The flood of 1973 brought a halt to some industrial operations in this area and caused extensive damages to commercial establishments in the Alton business district.

INTERIOR FLOODING

Some of the most severe flood problem areas in the American Bottoms portion of t PIWOCA planning area are the result of interior flooding. This is particularly true in the highly urbanized southern portion of the Wood River Drainage and Leve

istrict. Frequent flooding in this area is the result of runoff from the adjacent
pland areas and the total absence or lack of adequate drainage facilities in the
owlands for retention and/or delivery to a suitable outlet or discharge point.

o a great extent the current situation can be attributed to man's activities with-
n the area which have altered the physical environment in both upland and flood
lain areas. The accelerated pace of urbanization in the bluff area during recent
ears has increased the velocity of upland runoff to the bottoms. At the same time,
an was busily destroying the natural system of drainageways and detention areas in
he bottoms. Through agricultural and urban activities, natural drainageways have
een obliterated or diverted; many low areas which, in the past, served as wet
eather lakes during periods of heavy precipitation, have been utilized for landfill
perations and urban development. In addition, destruction of the natural drainage
ystem was accomplished with no provision for substitute man-made facilities to
ccommodate surface runoff from the tributary upland and bottomland areas. As a
esult, annual damages due to interior flooding have steadily increased in this
rea since 1940.

LOOD CONTROL ACTIVITIES

fforts to control flooding within the PIWOCA planning area began in the early
900's with organization of the Wood River Drainage and Levee District. Since that
ime, numerous studies and projects concerning both riverine and interior flooding
roblems have been completed by local, state and federal agencies. The major plan-
ing efforts of these agencies are reviewed below.

ederal Efforts

ood River Area - In 1938, the Corps of Engineers was authorized to provide flood
rotection for the Wood River Drainage and Levee District. The project provided
or the construction and/or improvement of a system of front and flank levees for
rotection against 200-year floods on the Mississippi River and tributary streams;
onstruction of related works consisting of gravity drainage structures, alter-
tions to existing or construction of new pumping plants, surfacing of service road
n the levee crown, alterations to railroad tracks and bridges at levee crossings,
eepage control measures, and construction of a low-water dam at the mouth of Wood
iver.

ne project was completed in 1968 at a federal cost for construction of $14,630,000,
xcluding $23,000 of contributed funds. The damages that would be prevented if the
roject flood occurred are estimated to be not less than $280,000,000. Cumulative
amages prevented since the beginning of construction are estimated at $930,000.[1]

n 1957, the Congress authorized the Corps to determine the engineering and eco-
omic feasibility of improvements for the control of interior flooding in the Wood
iver Drainage and Levee District. The solutions investigated for reducing or

eliminating interior flood damage due to overflow of the existing drainage system and for blocked drainage included enlarging the existing drainage system, provisi of hillside reservoirs, diversion of hillside runoff, detention areas, and installation of additional pumping stations.

As a result of the study, it was found that none of the foregoing solutions inves gated

> . . . were economically justified despite the relatively high average annual damages experienced in some of the flooded areas. In making this determination, future developments were taken into consideration. Removal of flood water via northern outlets was unusually expensive because of damages and relocations involved along right-of-way through highly developed localities. When removal via the more southerly outlets was tried, channel sizes became large as increments of drainage areas were acquired along the route to the outlets considered. As a result of these physical and economic impediments, no further consideration was given to any of the foregoing plans of improvement. All showed benefit-to-cost ratios substantially less than unity.[2]

Since all plans for complete drainage of the lower Wood River area lacked economi feasibility, a less extensive plan was studied which would reduce flood damages a remove flood waters from areas lying south of the Illinois Terminal Railroad. Th proposed plan, as documented in the Corps' 1962 survey report (House Document No. 150 of the 88th Congress, First Session - 1963), consisted of the following major elements:

- A pumping station in the vicinity of outlet 32 (along Cahokia Diversion Channel west of Illinois Route 111) with a discharge capacity of 45 c.f.s. at 9-foot static head and a maximum head capacity of 30 c.f.s. at a 25-foot static head. The pump will start operating at elevation 421 with a gate-closing stage of 419. It will operate an average of 12 days per year with an estimated maximum of 38 days per year. The station will consist of two 22-1/2 c.f.s. pumps which are capable of removing 0.24 inch runoff in 24 hours from the tributary area of 4,565 acres.

- Existing ponding area in Grassy Lake with a normal storage capacity of 64 acre-feet, and a maximum capacity of 243 acre-feet.

- A V-type collector ditch, 1 on 3 side slopes, 8,840 feet long, which would convey water from the adjacent eastern areas to the pumping station when outlets were closed due to high river stages. Area controlled, 881 acres.

- A V-type collector ditch, 4,240 feet long to collect and transport water from the adjacent western areas to the pumping station. Area controlled, 589 acres.

- Enlargement of the existing ditch from Grassy Lake to the pump station. The enlarged ditch would be a V-type ditch for a distance of 3,740 feet.

he proposed plan of improvement as cited above required the acquisition of 9 acres f rights-of-way for the ditches and pumping station site. Total project cost es- imates, based on July, 1962 prices, indicated federal costs at $179,000 and non- ederal costs at $14,000. Although authorized for construction by the Flood Con- rol Act of 1965, the project has received little attention and remained a low- riority project for ten years. Recently, at the request of the State of Illinois, unds for the continuation of preconstruction planning were included in the Corps' udget applications for 1975 and 1976. If these funds are appropriated, a Phase I eport can be prepared to reinvestigate the feasibility of providing interior flood ontrol improvements for the lower part of the district. The St. Louis District ngineer has indicated that the study will include a reexamination of the drainage roblems in the Herman Lake, Smith Lake, and West Roxana areas (areas for which o economically justified solution could be found in 1962).

lton Area - Flood protection for the main business district of the City of Alton ould be provided by another Corps of Engineers' project authorized by the Flood ontrol Act of 3 September 1954. The plan of improvement, which is documented in ouse Document 397 of the 83rd Congress, 2nd Session, provides for a levee and loodwall about 3,660 feet long, sewers and drainage structures, and a pumping lant. Further work on planning has been deferred until such time as local cooper- tion is assured.

ost of the project is estimated at $7,860,000, of which $6,790,000 is federal and 1,070,000 is non-federal.

amages that would be prevented if the specific project flood occurred, against hich the flood control works are designed to protect, are estimated at $8,875,000.[3]

tate Efforts

he active role currently being played by the State of Illinois in the interior looding problems of the Wood River-East Alton area was initiated through the fforts of area state legislators. In 1972, State Senator Vadalabene sponsored egislation for a State of Illinois engineering survey and report on these flood roblem areas. Although, due to an executive veto, the Senator's efforts were nsuccessful, similar legislation, introduced by Representative John Sharp during 973, successfully passed both Houses of the Assembly and received executive pproval. This flood control legislation, House Bill 285, 78th General Assembly, ppropriated $20,000 to the Department of Transportation, Division of Water esources, to make an engineering survey and report on flood control and drainage n Madison County.

During the same year, Representative Ken Boyle introduced a companion bill, House Bill 1041, which called for an appropriation of $220,000 to the Illinois Departme of Transportation for construction of flood control, drainage and other water resource improvements in East Alton, Wood River and adjacent areas in Madison Count

As a result of the above-noted legislative efforts, the Illinois Division of Wate Resources initiated a study of the interior flooding problems in the Wood River-East Alton area in 1974. For information concerning major activities involved in the Division study and the proposed plan of improvements, the reader is referred Appendix C of this report.

Local Efforts

Organized local efforts to control riverine flooding within the PIWOCA planning area began during the early 1900's with the formation and subsequent activities c several single-purpose districts--the Wood River Drainage and Levee District, the Foster Drainage and Levee District, the Cahokia Creek Drainage and Levee District and the Indian Creek Mutual Drainage District.

The Wood River District's activities in the American Bottoms area north of the Cahokia Diversion Channel have had the greatest impact on riverine flood control. Through local sponsorship of the Corps of Engineers extensive levee and pumping station construction projects, superior operation and maintenance procedures, anc cooperation with local industries in related flood control projects, flood damag caused by riverine flooding have virtually been eliminated within this District. Unlike its sister agency, the East Side Levee and Sanitary District, which since 1907 has provided interior flood control facilities for the larger portion of the American Bottoms south of the Cahokia Diversion Channel, interior flood control h not been included in the activities of the Wood River District.

The question of the District's responsibility in the control of interior floodin was clarified by a court order of the Third Judicial Court (Order No. 70-Z-17). The decision, handed down by Associate Circuit Judge Fred Schuman June 24, 1971, was in response to a petition filed on February 16, 1970 by the City and Townshi of Wood River and residents of the interior flood prone areas of Lincoln Additio and Glendale Gardens. The petition sought to force the District to provide drai age for both areas which flood heavily and regularly each spring.

The Court ruled the District could not provide drainage facilities for the benef of certain portions within its boundaries. Citing a 1909 petition for organizat of the District, the Court decision said the District was formed to protect the land within District boundaries from riverine flooding (overflow of the Mississip and the Wood River). Judge Schuman, in handing down the Court's decision conclu ". . . that petitioners should proceed under the drainage act to organize a subdistrict in order to obtain the relief they desire."[4]

The remaining drainage districts listed above were organized for local project purposes in largely agricultural areas, not included in critical flood prone are thin the planning area. The location, accomplishments and current activities of iese Districts are presented elsewhere in this report (Chapter 3).

addition to the drainage districts discussed above, local responsibility in ainage and interior flood control within the three-basin planning area lies with unty, township and municipal governmental units. Two of these entities, the ty and Township of Wood River, have provided the most notable effort toward major ainage solutions. The search for a solution to the severe interior flooding oblems in the Wood River area has persisted for more than twenty years--a period aracterized by numerous local studies, some documented in the engineering reports local engineering firms.[5]

er the last few years, several remedial projects have been completed by Wood ver Township and the City of Wood River. Projects were designed to alleviate ooding in Lincoln Addition, Glendale Gardens Subdivision, and Eastwood Sub- vision. Other interim remedial proposals (i.e., a proposal to construct a storm wer to drain the intersection of Illinois Routes 143 and 111 and the area to the st) were suspended pending the results of the Division of Water Resources study d drainage planning activities.

anticipation of a major local financial commitment, the Mayor of Wood River ap- inted a steering committee in December, 1974 to evaluate the alternative drainage oposals and recommend to the City Council a plan to alleviate flooding conditions thin the city and surrounding environs; and to evaluate alternative proposals for nancing and to recommend a financial program for the implementation of the recom- nded plans.

nce the scope of the flood problem area involves portions of several governmental its, the most critical need is a locally acceptable areawide mechanism authorized perform and finance the duties of a local sponsor in federal and state drainage ojects.

LOOD PLAIN MANAGEMENT

storically, attempts to reduce flood damages in the PIWOCA planning area have been rough the exercise of control over the Mississippi River and hillside runoff. til recently, control over the use of land lying in the flood plain, through the anned development and management of flood hazard areas, had not been applied. plication of the disaster concept (construction of flood control facilities to otect the works of man against the forces of nature's floods) has not been culiar to this area, but national in scope.

e alarming rate of increase in flood damages each year despite increased public penditures for flood control led to a change in national flood control policy in e 1960's. Land use controls (flood plain regulations), the recently emphasized tional approach to flood damage reduction, are designed to minimize flood damages restricting, controlling, prohibiting or prescribing certain types of land use. e authority to impose flood plain regulations is vested in the zoning and build- g code powers given to counties and municipalities in Illinois.

Although storm runoff is considered in many of the ordinances adopted by the count and municipalities within the PIOWCA planning area, the regulatory measures prescribed in these documents are generally ambiguous rather than specific. The def ciencies of these ordinances can be attributed, in part, to local desires but, more importantly, to the lack of knowledge concerning the causative factors involved in the flood problems and a misunderstanding of land use control concepts.

The State of Illinois, through legislation and the efforts of the Division of Wat Resources, has an active flood plain management program. An amendment to the "Rivers and Lakes Act," passed by the General Assembly in 1971 authorizes the Illinois Department of Transportation to define flood plains in Illinois, publish appropriate maps and data, cooperate with local units of government, and institut a permit procedure for regulating construction on the flood plain.

Federal action has been applied through the National Flood Insurance Program. Th federally subsidized insurance program, authorized by the National Flood Insuranc Act of 1968, as amended, is administered by the Federal Insurance Administration the Department of Housing and Urban Development. The Flood Disaster Protection Act of 1973 instituted a renewed emphasis for flood plain management as well as p viding low-cost flood insurance. Local units of government who elect to participate in the program are provided with detailed flood plain information by FIA. They then are expected to adopt local measures to meet the severity of the determined flooding problem. As long as the community maintains eligibility in the pr gram, its residents are eligible to purchase the subsidized flood insurance. Ler ing institutions, through the Flood Disaster Protection Act and other related legislation, are prohibited from approving mortgages on structures located withi a designated flood hazard area, unless the borrower purchases flood insurance to cover the loan. The entire federal effort, described briefly here, has been to assign the responsibility for minimizing flood damages to the local level where i can best be enforced. No longer can individuals rely on a disaster declaration aid in reclaiming the costs of flooding damages. Most federal programs involvin grants or loans are bound by the same requirement as for lending institutions.

Local units of government eligible for the flood insurance program include Madis County and eight of the nine FIA-designated municipalities located within the PIWOCA planning area.

Future prevention of flood damages in the planning area through the successful application of land use controls (flood plain regulations) will depend on the active participation of all levels of government--federal, state, and local. At the present time, however, major activity has primarily occurred through legislation and various programs at the federal and state level. Historically, the pol ical process at the local level tends to negate these higher-level government efforts. Since the active participation of local government is essential to the successful prevention of flood damages in the PIWOCA planning area, there is a n for change in the philosophy of local governments concerning flood plain regulation.

* * * * *

U.S. Army Corps of Engineers, *Water Resources Development in Illinois* (Chicago, Illinois: 1971), p. 35.

U.S. Army Corps of Engineers, *Wood River Drainage and Levee District, Madison County, Illinois,* House Document No. 150, 88th Congress, 1st Session (Washington: 1963), p. 37.

U.S. Army Corps of Engineers, *Water Resources Development in Illinois*, p. 82.

City of Wood River vs. Wood River Drainage and Levee District, *Order No. 70-Z-17,* Illinois Third Judicial Circuit, June 24, 1971.

C.H. Sheppard and C.F. Abraham, *Lincoln Place Addition Drainage Report,* March 7, 1947.

Russell, Axon and Associates, *Proposed Storm Sewer and Storm Drainage Improvements for City of Wood River*, (File No. 5829-B), November, 1963.

Russell, Axon and Associates, *Supplement to Engineering Report, Proposed Storm Sewer and Storm Drainage Improvements for City of Wood River,* January, 1964.

SCOPE AND NATURE OF THE PROBLEM

part two

CHAPTER 3
BASIN DESCRIPTION

CHAPTER 4
BASIN ANALYSIS

CHAPTER 5
PRINCIPLES FOR DRAINAGE MANAGEMENT

BASIN DISCRIPTION

3

ASIN DESCRIPTION

ffective surface drainage planning and management in the PIWOCA planning area rests ı an understanding of the interrelationship among the various physical, cultural id hydrologic components of the total three-basin drainage area which collectively efine the nature and character of the Planning Basins. Background information and echnical data concerning the principal physical and hydrologic characteristics of ie Piasa Creek, Wood River, and Cahokia Creek Planning Basins (PIWOCA study area) re presented in this chapter. In documenting completion of the data collection id analysis phase of the planning program, the material provides the data base for ie remaining problem definition and plan formulation phases of the program.

HYSICAL CHARACTERISTICS

ie physical character of an area, as defined by geology, topography, soil con- tions and climate, to a large extent controls the natural drainage pattern and ifluences in many ways the design, construction, cost and maintenance of storm rainage management facilities. The form, location, and distribution of these iysical characteristics and their relationship to riverine and internal flooding ı the PIWOCA planning area are discussed in the following paragraphs.

eology[1]

eologic features in the Planning Basins (the PIWOCA study area) are products of omplex depositional and erosional processes spanning millions of years of geo- ogic time. The bedrock formations which underlie the area were deposited during ie Paleozoic Era and subjected to erosion and weathering during the Mesozoic Era id the Tertiary Period. During the more recent Pleistocene Epoch, recurring con- inental glaciers deposited sediments, which were altered by weathering and ero- ional processes that dominated during warm periods between glaciations. During ie later Pleistocene, and especially the Holocene (recent) Age, the processes of rosion and weathering produced most of the major and minor features of the pres- it topography and formed the Modern Soil.

recambrian rocks, which are commonly referred to as the basement, lie at depths inging from about 4500 feet below the surface in the eastern part of the Cahokia reek Basin to about 3500 feet below the surface in the western part of the Piasa reek Basin. The depth to the Precambrian is essentially the thickness of the over- ing Paleozoic rocks. Paleozoic rocks are dominantly marine sediments, repre- enting repeated invasions of the sea into the interior of the continent. The seas enerally advanced from the south and land-derived sediments deposited in them came inly from the north, northeast, and east. Above the thick sandstone of the mbrian System, carbonate sediments are dominant through the middle Mississippian; iereas, shales and sandstone dominate the younger Pennsylvanian deposits.

ie uppermost bedrock in the Piasa Creek Basin is Mississippian Age. Mississippian rata are generally covered by glacial drift, but are exposed on some steep slopes ong stream valleys in the western part of the basin and in the bluffs of the

Mississippi River in western Madison County. Although limestone is the dominant rock type in the Mississippian System, varying amounts of siltstone, shale and san stone are also found. The uppermost bedrock in the Wood River and Cahokia Creek Basins and in the eastern part of the Piasa Creek Basin is Pennsylvanian Age. The thickness of the Pennsylvanian System above the Mississippian ranges from less tha a foot in the western part of the Piasa Basin to greater than 400 feet in the eastern part of the Cahokia Creek Basin. The Pennsylvanian rocks, locally exposed by erosion, are typically 90 to 95 percent clastic rock. Sandstones commonly constitute 60 percent of the lower part of the section. Most of the remainder is siltstone and shale and less than 1 percent is coal and limestone. Sandstones constitute about 25 percent of the middle and upper parts of the system. In the upper part of the section, shale and underclay commonly form 65 to 70 percent of the sequence. In general 5-10 percent of the upper two-thirds of the sequence is limesto

In the Planning Basin areas (PIWOCA study area), the surface of the bedrock was exposed to post-Pennsylvanian erosion and weathering until Pleistocene time, when it was buried by glacial drift. Kansan glaciers first covered the area, depositing thick till deposits, which were deeply eroded and weathered during the subsequent Yarmouthian interglacial Age. The Yarmouthian surface was buried, in turn, by Illinoian drift, which was eroded and weathered during the Sangamonian interglacial Age.

About 70,000 years ago, a shift toward colder climatic conditions ended the Sangamonian and signaled beginning of the Wisconsinan stage of glaciation. Even though Wisconsinan glaciers advancing into northeastern Illinois did not reach the PIWOCA study area, Wisconsinan Age sediments do constitute a large proportion of the surface sediment in the three Planning Basins. During the Wisconsinan, the headwaters of the Mississippi River Valley and its tributaries channeled large volumes of sediment-laden meltwater from the Wisconsinan glaciers, and the Mississippi Valley in the PIWOCA study area was filled with outwash sediment to a level at least 445 feet in elevation (some 145 feet higher than its bedrock valley and 47 feet higher than the present river level of 398 feet). Remnants of this valley fill occur as terraces in the American Bottoms and as lake deposits in tributaries to the Mississippi. Following periods of flooding, fresh outwash sediment were left exposed on the broad flood plains. Winds dominantly from the west eroded silt and clay sized material, transported it in dust clouds and deposited it as loess on the upland part of the study area.

Since major loess deposition ceased about 12,000 years ago, the Mississippi River has lowered its grade and reworked much of the glacial valley fill. Streams in th upland have incised themselves into Wisconsinan loess, older drift, and bedrock. Materials at the surface have been exposed to weathering of the Modern Soil.

Surficial Geologic Deposits - The materials discussed below occur at the surface in the PIWOCA study area and have to be dealt with whenever man attempts to cut, construct, fill, excavate, drill, or conduct almost any of his varied activities. The distribution of the surficial deposits is shown in Plate 3 and the engineerin properties of these deposits are shown in Appendix G of this report.

edrock and Illinoian drift of the Glasford Formation are seldom exposed at the urface, but they are significant here because they occur at shallow depths and may e encountered in excavations.

he dominant surficial deposit in the upland portion of the PIWOCA study area is isconsinan loess, which is separated into the Roxana Silt and the overlying Peoria oess. The Roxana and Peoria are similar in many respects, but have slightly diferent mineral compositions. Locally the Robein Silt, an organic silt or peat, ccurs between the Peoria and Roxana. Both loesses, when unweathered, are dominanty silt-sized sediment with 5 to 25 percent clay and usually less than 5 percent and. The Roxana contains only 3 to 5 percent more clay than the Peoria.

hickness of the loess is shown on Plate 3. Thickness lines represent the combined hickness of the Peoria Loess and Roxana Silt on level upland topography where ost-depositional erosion has been minimal. The Robein Silt is included where resent. The greatest observed loess thickness occurs along the bluff close to the merican Bottoms. A maximum thickness observed in this area is 53 feet measured n a core near the bluff in the Cahokia Creek Basin. From the bluff, the loess hins to less than 10 feet in northeastern Cahokia Creek Basin.

he Carmi Member of the Equality Formation consists of silty and clayey sediments eposited in lakes in the valleys of the Wood River and Piasa, Indian and Cahokia reeks. Remnants of these lake plains occur as terraces in Piasa, Indian, and ahokia Creeks, but appear to be absent in the valley of the Wood River terraces. he Carmi Member is covered by Peoria Loess on terraces, and it is commonly found n the subsurface below Cahokia Alluvium in tributaries to the Mississippi Valley.

he Mackinaw Member of the Henry Formation occurs in terraces and in the subsurace below Cahokia alluvium in the American Bottoms. It consists of sand and ravel outwash from Wisconsinan glaciers and is the principal aquifer for wells in he American Bottoms. In terraces, the Mackinaw Member is frequently overlain by indblown sand of the Parkland Sand.

he Cahokia Alluvium, the dominant material exposed at the surface in the American ottoms, consists of silt, clay, organic materials and interbedded sand bodies. urficial alluvium in the American Bottoms tends to be more clayey than the silty lluvium found in upland streams. Near the Mississippi River, the Cahokia is more andy than elsewhere. Over most of the American Bottoms, the Cahokia overlies sand nd gravel of the Henry Formation.

he Peyton Colluvium includes a variety of material types found in slopewash and reep deposits on steep slopes in western Piasa Creek Basin. Residual cherts rom the Mississippian bedrock are frequently mixed with loess in these areas.

an-made deposits mapped in the area are quarries. Man-made deposits and the eyton Colluvium are not characterized in the Engineering Data Table because suficient data are not available.

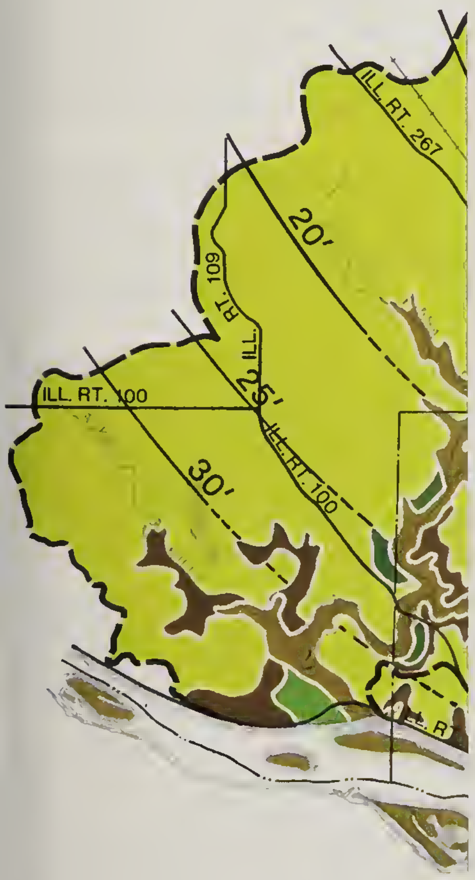
Table 1
LOCATION AND THICKNESS OF LOESS

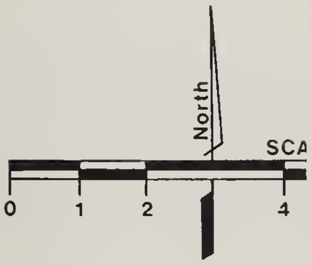
Map No.	Location	Thickne of Loes
1	T 6N, R 10W, Sec. 14, SE, NW, SW	20'
2	T 6N, R 10W, Sec. 35, SW, SE, SE	19'
3	T 5N, R 10W, Sec. 2, SE, SE, SW	37'
4	T 5N, R 9W, Sec. 18, SW, NW, NW	30'
5	T 5N, R 9W, Sec. 8, NE, NW, NW	27'
6	T 5N, R 9W, Sec. 6, SE, SE, NW	17'
7	T 6N, R 9W, Sec. 32, SE, NW, SW	25'
8	T 6N, R 9W, Sec. 30, SW, SW, SE	20'
9	T 6N, R 9W, Sec. 33, NE, SE, SW	24'
10	T 6N, R 9W, Sec. 34, NE, NW, SW	22'
11	T 6N, R 9W, Sec. 23, NW, SW, NW	15'
12	T 6N, R 8W, Sec. 17, SW, SW, NE	12½
13	T 6N, R 8W, Sec. 15, SE, NE, SW	8½
14	T 5N, R 8W, Sec. 3, NW, NE, SE	12'
15	T 5N, R 8W, Sec. 8, SE, SE, NW	16½
16	T 5N, R 9W, Sec. 13, SW, NE, SE	24'
17	T 5N, R 9W, Sec. 36, NW, SE, NE	53'
18	T 4N, R 8W, Sec. 9, SW, NW, NE	31'
19	T 4N, R 8W, Sec. 15, NE, NW, NE	17'
20	T 4N, R 8W, Sec. 3, NW, SW, SE	21
21	T 5N, R 8W, Sec. 27, SE, NE, NW	16
22	T 5N, R 8W, Sec. 14, NW, SW, NW	13
23	T 5N, R 8W, Sec. 11, NE, SE, NE	9'
24	T 5N, R 7W, Sec. 8, SE, SE, SE	9
25	T 4N, R 7W, Sec. 17, NE, SE, SW	22
26	T 4N, R 8W, Sec. 24, NE, SE, NW	14

PLATE 3

BASIN GEOLOGY

PIASA CREEK, WOOD R





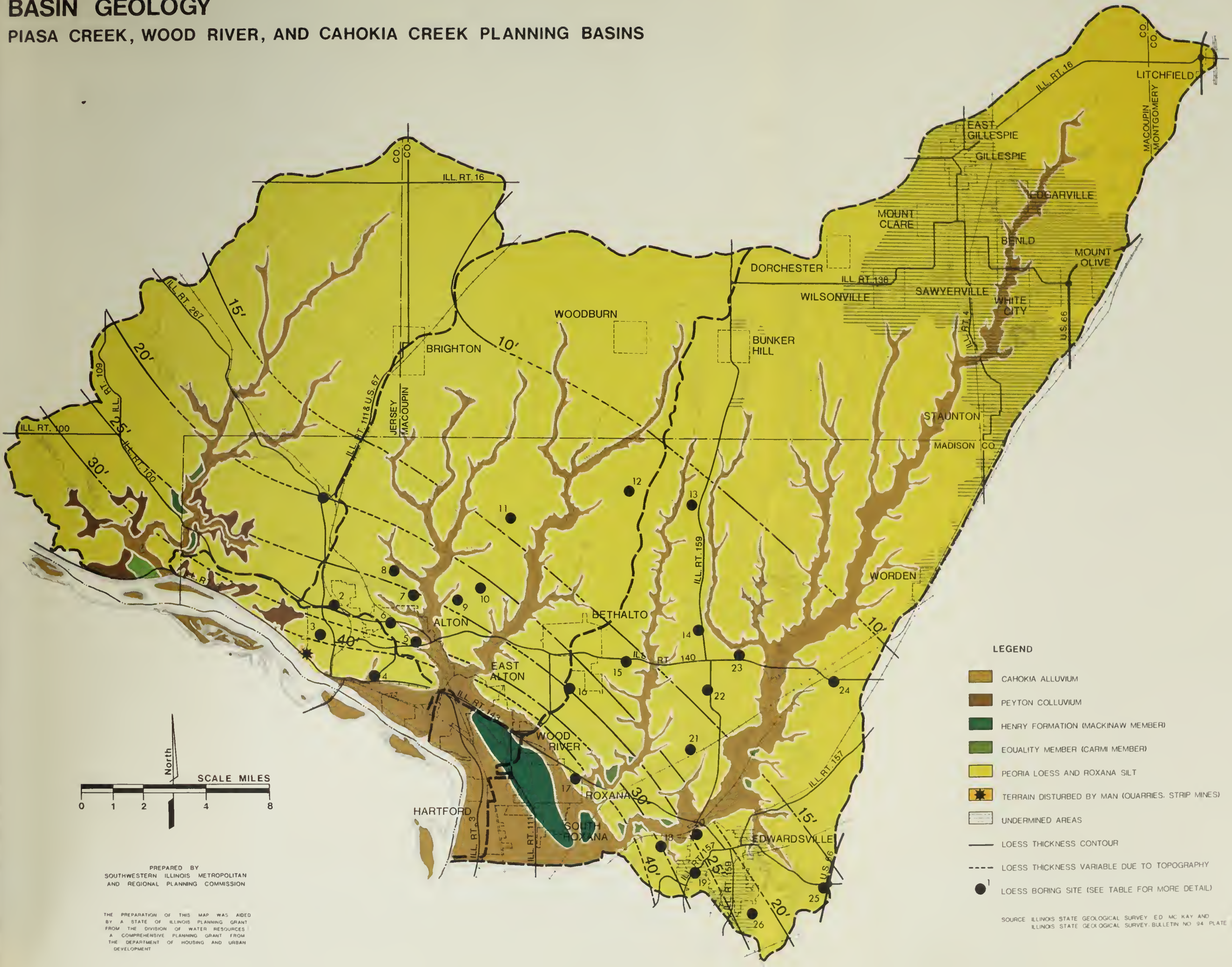
PREPARED BY
SOUTHWESTERN ILLINOIS METR
AND REGIONAL PLANNING CO

THE PREPARATION OF THIS MAP
BY A STATE OF ILLINOIS PLANNI
FROM THE DIVISION OF WATER R
A COMPREHENSIVE PLANNING GRA
THE DEPARTMENT OF HOUSING AN
DEVELOPMENT

PLATE 3

BASIN GEOLOGY

PIASA CREEK, WOOD RIVER, AND CAHOKIA CREEK PLANNING BASINS



SOURCE ILLINOIS STATE GEOLOGICAL SURVEY ED MC KAY AND
ILLINOIS STATE GEOLOGICAL SURVEY, BULLETIN NO 94 PLATE

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pography

e topography of the three-Planning-Basin PIWOCA study area has been shaped by the rces of erosion and deposition. In general, the area consists of two sharply con- asting topographic areas: (1) the flood plain of the Mississippi River, an almost vel alluvial plain; and (2) the upland area consisting of steep erosional slopes, rrow stream valleys, and relatively broad ridges in the upper reaches of the sins. Degree of slope variation within the study area is shown on Plate 4.

the American Bottoms portion of the study area, topography has been shaped by a ccession of former channels of the Mississippi River. Topographic features asso- ated with river and tributary stream meanders include oxbow lakes, sand bars, rraces, meander scars, sloughs and swamps.

the uplands,which rise 150 to 200 feet above the Bottoms, are a portion of the stern upland loess-covered till plain. Near the Mississippi River, the upland ea has been highly dissected by a series of streams which have gradients of 30 to feet per mile.

pography is a major factor contributing to storm drainage and flooding problems the Planning Basins. The nearly level terrain of the alluvial areas (flood ains) of the Mississippi River and the lower reaches of the major streams in the OCA study area do not provide for the efficient movement of surface water into early defined drainageways. Under natural conditions, surface water must meander owly to the Mississippi River or remain in numerous minor depressional areas roughout the lowland areas. This problem is amplified by the velocity of the land runoff which results from the sharp contrast in terrain between the bluff ea and the flood plains.

ls

parent materials of the soils in the PIWOCA study area are almost entirely of acial origin. Because of the landform division of this study area into upland alluvial plain sectors and the variety of parent materials found within each ctor, however, the soils of the basins are varied.

though a detailed soil survey has been completed for the Jersey County portion of Piasa Creek and the Wood River drainage basins, the absence of similar detailed ils information in the Madison County portion led to the use of general soils sociations for the purposes of this report. The nine general soils areas delin- ted within the three-basin study area are shown on Plate 5 and are discussed in tail in Appendix H of this report.

rough their ability or inability to absorb water, soils greatly affect surface noff and, therefore, storm water runoff management planning. Based on rates of filtration (the rate at which water enters the soil at the surface), the Soil nservation Service has divided soils into four hydrologic soil groups. These ups range from Group A, which represents soils having a low runoff potential due high infiltration rates--primarily deep, well-drained sands and gravels to Group

D which represents soils having high runoff potential due to very slow infiltration rates--primarily clays with high swelling potential, soils with permanently high water tables, soils with a claypan or layer high in clay at or near the surface, and shallow soils over nearly impervious parent material.

The spatial distribution of hydrologic soil groups, which range from Group A thru Group D/C in the PIWOCA study area, is shown on Plate 5. Group B soils are predominant in the upland areas which rim the American Bottoms; Groups C and C/D soils (soils with greater runoff potential) are located in the remaining upland area near the headwaters of the major study area streams. Only two hydrologic soil groups are represented in the American Bottoms--Group A in the Wood River Terrace area, and Group D in the remaining area.

Landform Regions of the American Bottoms[2]

A further refinement of landform identification in the American Bottoms, the Illinois flood plain of the Mississippi River which lies between Alton and Dupo, facilitates problem analysis in this complex region. Seven physical regions have been delineated within the flood plain by the physical factors of geologic origin, soils, and topographic breaks and patterns. Four of the seven regions delineated within the northern portion of the American Bottoms located within the PIWOCA planning area include: (1) The Terrace Region, (2) The Bluff Meander Belt, (3) The Ridge and Swale Region, and (4) The Aggraded Cut and Fill Region. The physical characteristics of each region, which directly relate to the type and severity of drainage problems, are described below.

Terrace Region - The Terrace Section of the American Bottoms lies in the norther part of the flood plain, mostly above the confluence of the Missouri River, The terraces, the largest of which is called the Wood River Terrace, are the only places in the Bottoms where the Henry Formation is exposed at the surface (Plate 3. The soils are either silty or sandy with a few pebbles, contain little humus, and have poor water-holding qualities. When dry, the silts and sands are white or pin-ish white, much in contrast to the darker river silts. The medium to coarse sands are well-sorted and have a mineral content of 75 to 80 percent quartz, 13 to 25 percent feldspar, and 2 to 6 percent other materials.

The Wisconsin valley train has not been eroded away because of the stability of th Mississippi above the mouth of the Missouri and, consequently, lacks the cut and fill of the other areas. The terraces lie at an elevation of 430 to 445 feet above sea level, some 30 to 40 feet above the river and 10 to 25 feet above the mantle of younger Cahokia Alluvium.

The terraces do not connect with the bluff, but are separated from it by the Bluff Meander Belt and are cut into isolated segments by Wood River, Cahokia, and Indian Creeks. Wood River and Cahokia Creeks once flowed Yazoo fashion in a southerly direction, in and out of a series of lakes at the base of the bluff. The resultan cut and fill action of these tributaries removed the older Pleistocene materials and cut the terraces into scattered segments.

PLATE 5

HYDROLOGIC

PIASA CREEK, WO

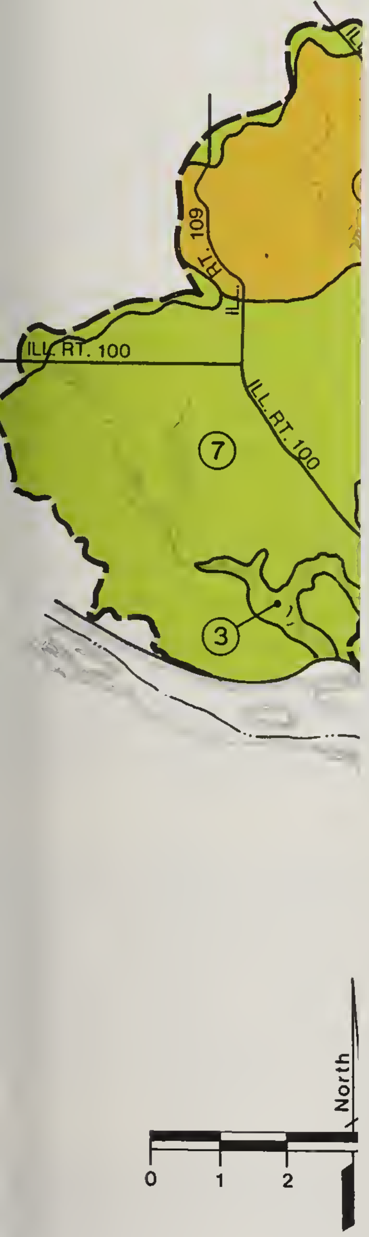

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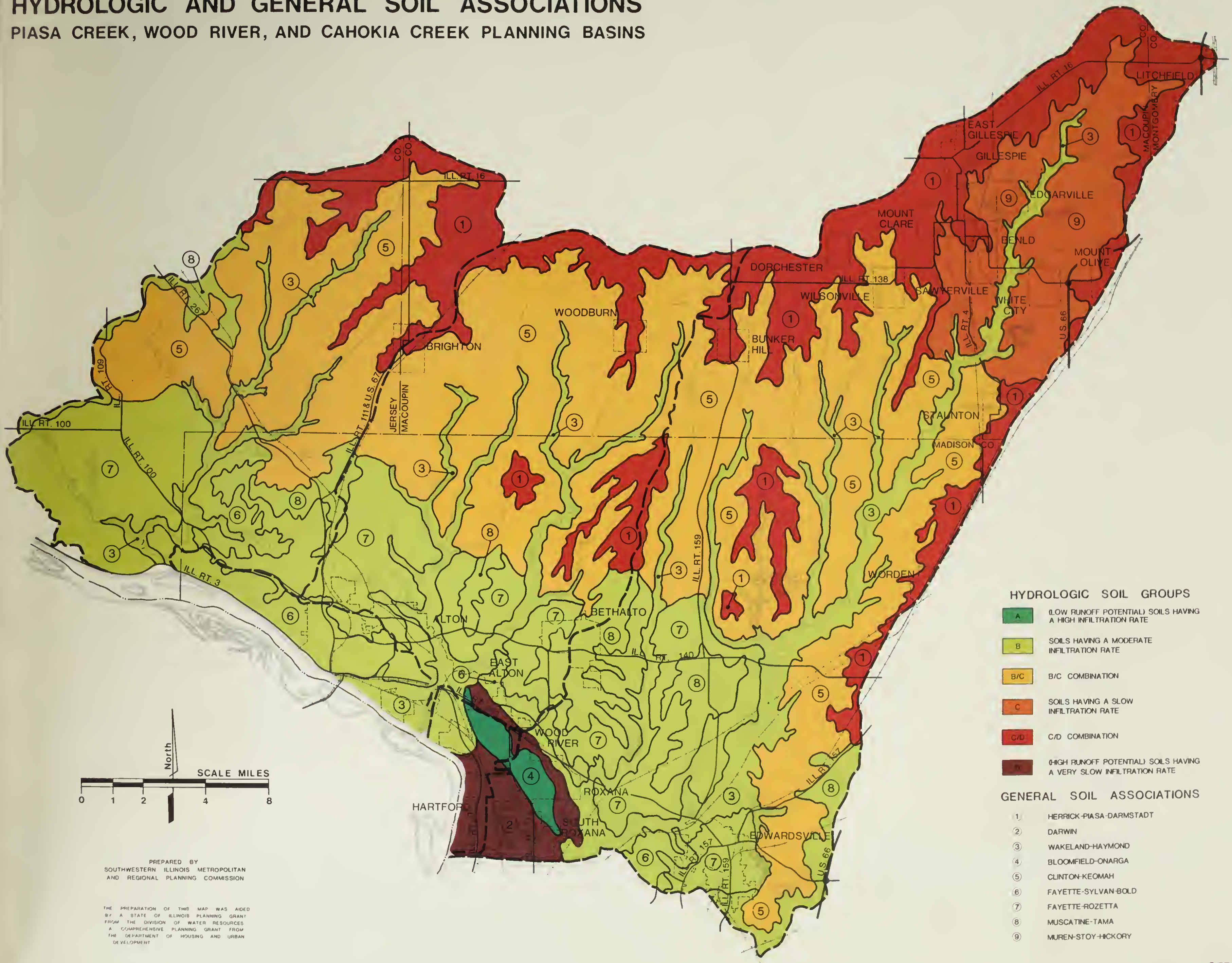
PLATE 5

HYDROLOGIC AND GENERAL SOIL ASSOCIATIONS

PIASA CREEK, WOOD RIVER, AND CAHOKIA CREEK PLANNING BASINS



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SOURCE: U.S.D.A., SOIL CONSERVATION SERVICE he Wood River Terrace is approximately 6 miles long and averages 1 mile in width. rior to 1910, the terrace was an agricultural area famous for its melons. However, rban and industrial expansion subsequently occurred on this naturally elevated errace.

luff Meander Belt - The Bluff Meander Belt lies adjacent to the upland in the orthern Bottoms and includes the former drainageways of Wood River and Cahokia reek. In the past, those streams entered the flood plain and flowed parallel to he river, in Yazoo fashion, for several miles before joining the master stream. In oth cases, the streams have cut away the terraces from the bluff, and one of the eander patterns of Cahokia Creek separates the terrace into northern and southern ections. Cahokia Creek, the largest stream that flows into the Bottoms, once ntered the flood plain and flowed south for 25 miles to Cahokia Chute. With a radient of only 2 or 3 inches to the mile, this sluggish stream followed several hannels during periods of high water. In 1915, the Cahokia Diversion Channel was onstructed to carry the waters from the upland due west to the river. This leveed hannel forms the southern boundary of the PIWOCA portion of the American Bottoms.

he most recent channel of Wood River Creek was west of the terrace in East Alton, man-made channel shortened the meandering across the Bottoms from 2 to 4 miles in he 1950's. The old drainageway lies east of the terrace; the stream probably lowed south for 8 miles before joining Cahokia Creek. This old drainageway, which ies between the terrace and the bluff, presents the greatest problem in terms of ong-range regional planning. Sections of the sag already contain low-cost marginal ousing which experiences flooding nearly every year. In addition, zoning changes n the area have allowed filling and development in old lake beds, which in the past rovided natural ponding areas for storm water runoff. It should also be noted that he absence of water in these old lake bed areas today is partially due to the heavy umping of ground water by nearby Shell Oil Company. If the company should decide o go to the river for the bulk of its cooling water, these old lake bed areas will robably reappear as permanent bodies of water.

dge and Swale Region - The Ridge and Swale Region lies adjacent to the river and s the section with the most recent cut and fill action. In the past, this was a egion of swamps, partially filled water courses, active sloughs, natural levees, d sand bars. Today, most of the Ridge and Swale Region lies behind the 200-year evees along the river. Much of the area has been filled and is now chiefly occu- ed by industrial concerns.

graded Cut and Fill Region - The Aggraded Cut and Fill Region is the least banized area of the Bottoms area and presents the most problems for the future. e region lies between the terraces and the ridge and swale, and has serious prob- ms with internal ponding, high water table, and high shrink-swell clay soils. oreover, the more suitable areas surrounding the cut and fill region have become arly saturated with urban development, and development is now encroaching upon the t and fill region before proper drainage solutions are implemented.

The unique character of the region which makes drainage solutions more difficult i the extreme flatness. The surficial features of cut and fill have been eliminate over time by the aggrading action of the Yazoo streams. Additionally, soil in the area is classified by the USDA Soil Conservation Service as the Darwin Association a poorly developed series consisting of fine-textured clay which has extremely lo permeability, high runoff potential, and high frost heave potential.

The region is currently zoned agricultural and any variance from this in the futur must be associated with adequate planning for surface ponding and runoff. However it presently appears that engineering procedures for any development would be extremely costly.

DEVELOPMENT CHARACTERISTICS

Man, through his activities in occupying and developing the land, has a powerful influence on the physical and hydrologic environment. In the Piasa Creek, the Wo River, and the Cahokia Creek Planning Basins, the most profound man-made change has been the highly complex transformation known as urbanization in which undevel ed or agricultural land is changed into concentrated centers of people, buildings and activities. The urbanization process has occurred primarily in the PIWOCA planning area (the Madison County portion of the three-basin study area).

The gradual urbanization process, by altering the physical landscape and disrupti natural drainage patterns, has greatly affected the rate of storm runoff and floo damages in the planning area. As a result, urbanization has brought with it the inevitable demand for flood control and storm drainage services.

Planning storm drainage systems which will satisfy current needs and demands requires knowledge of the areal distribution of the population and the existing patterns of development; planning for future needs requires projection of population growth and distribution, and a study of development patterns anticipated in the future. General information and statistical data concerning current and projecte economic development, land use configurations, and population distribution in the PIWOCA planning area are presented in this section.

Economic Development

Economic development, which has occurred primarily in the western portion of the PIWOCA planning area, has played an important role in the establishment of the Metro-East area as one of the most significant industrial complexes within the State of Illinois and within the St. Louis metropolitan area. This complex forms a major segment of the economic base of the Southwestern Illinois Region and, in large part, supports the service functions of the region's economy.

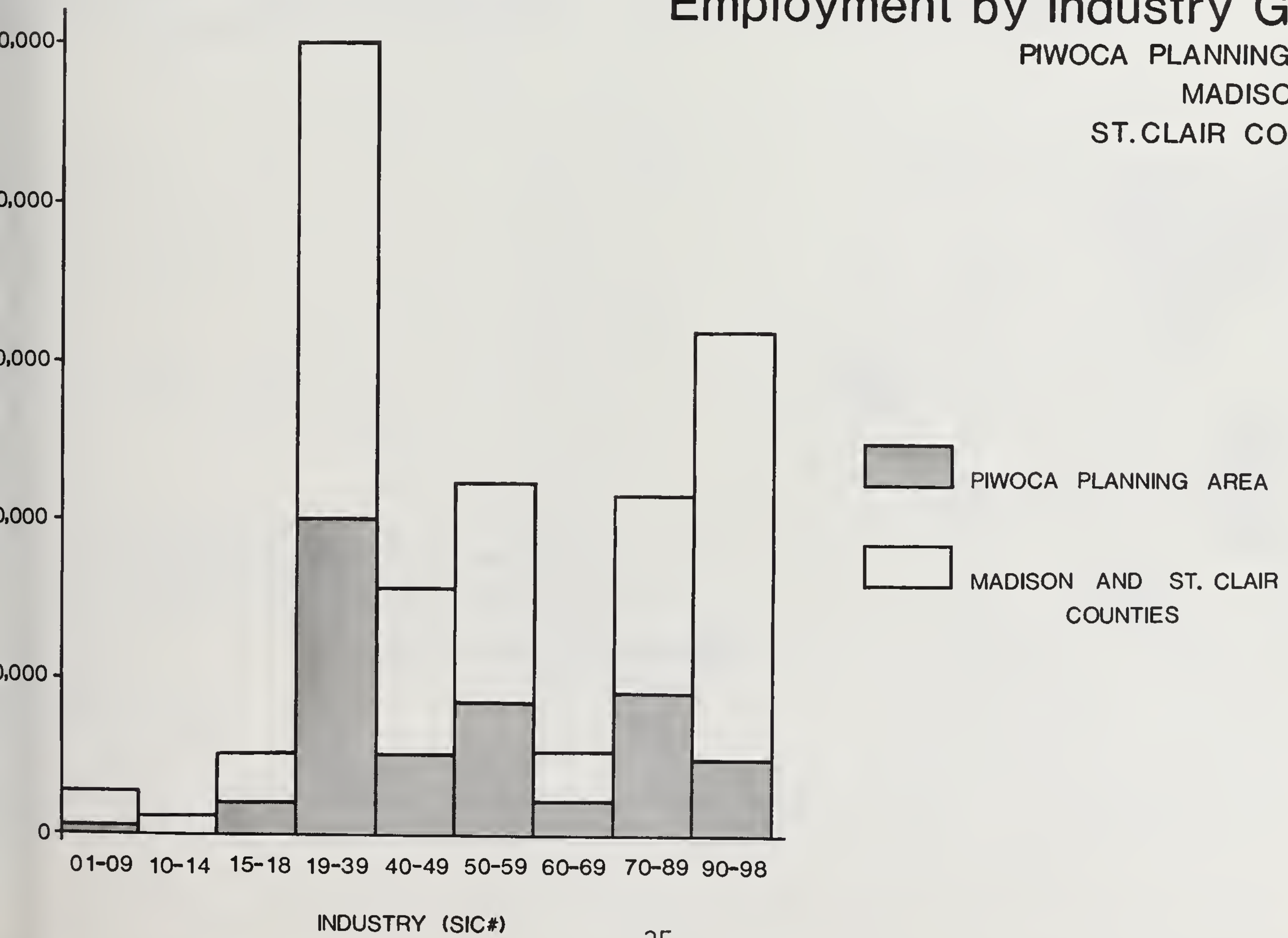
Historical Development - The permanent settlement of the area began in the earl 1800's with the establishment of villages or hamlets including Alton, Upper Alton, Milton, Edwardsville and Wood River. By 1812 Madison County had attained a opulation of about 1,000, most of which was located in the PIWOCA planning area. uring this early period of settlement, economic activity was concerned primarily ith subsistence agricultural and limited trade functions. By mid-century, the rea had become a major center for river traffic (Alton) as well as a significant gricultural producer with markets in nearby St. Louis.

ne decline in steamboat traffic during the latter part of the century coincided ith the expansion of railroad systems and the westward movement of industrial ctivity. During the years 1873-1900, a substantial portion of the industrial base f the area was established. Such firms as Owens-Illinois (1873), Duncan Foundry 1874), Olin-Mathieson (1892), and the Peavey Company (1874) ushered in a new era f industrial/economic development. After the turn of the century, the industrial ase of the area was further bolstered by the establishment of petro chemical, aperboard, and primary metals industries, which included AMOCO (1907), Alton Box oard Company (1910), Laclede Steel Company (1911), and Shell Oil Company (1917). n response to this industrial development, the population of the area rose from pproximately 15,000 in 1870 to 70,000 in 1930--an increase of 6.1 percent per year ver the sixty-year period. Between 1930 and the present, growth of the area's ndustrial base has been generated primarily from existing industry expansions and o a lesser degree from the development of new firms and plants.

PLATE 6

Employment by Industry Group

PIWOCA PLANNING BASIN
MADISON AND
ST.CLAIR COUNTIES



Economic Structure - The economic structure of the PIOWCA planning area is dominated by manufacturing. The industrial development which occurred around the turn of the century established the economic base for the area. Subsequent development has included the improvement and expansion of industrial production and distribution facilities, transportation systems, utility systems and an extensive service-oriented economy.

The distribution of employment by industrial group is shown on Plate 6. Approximately 20,000 or 13 percent of all industry employment opportunities within Metro East are located within the PIWOCA planning area.

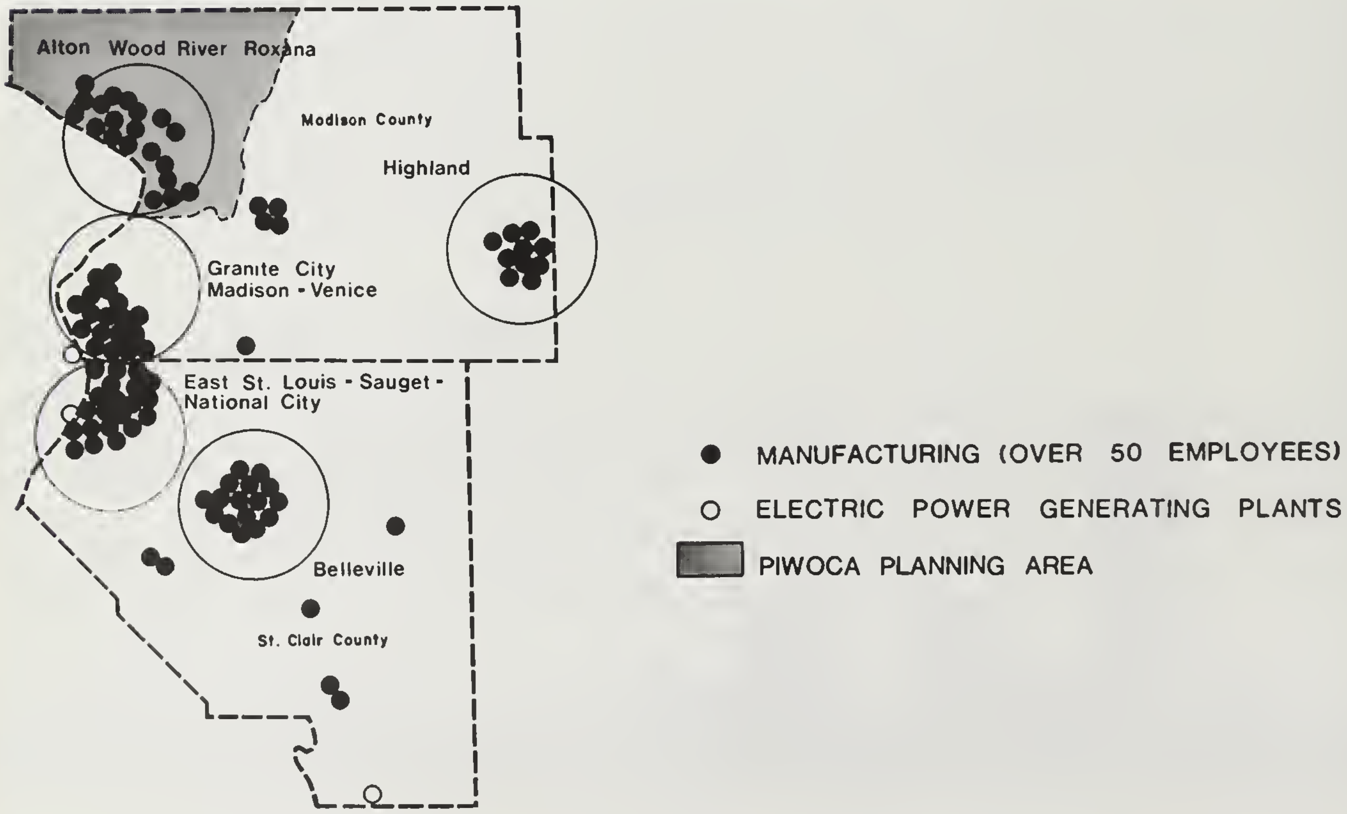
Manufacturing: Manufacturing industries (employing more than 50 persons) are generally concentrated within five areas in the Metro-East area, one of which is located within the PIWOCA planning area. These manufacturing concentrations located in Madison and St. Clair Counties include:

1. Alton-Wood River-Roxana - located within the PIWOCA planning area;
2. Granite City-Madison-Venice - located immediately south of the planning area;

PLATE 7

Distribution Of Major Manufacturing Industries

MADISON AND ST. CLAIR COUNTIES



3. East St. Louis-Sauget-National City - located south of the planning area;
4. Belleville - located southeast of the planning area;
5. Highland - located east of the planning area.

The distribution of major manufacturing industries in Madison and St. Clair Counties is illustrated on Plate 7. There are a total of approximately 95 manufacturing industries within the study area employing approximately 20,000 persons. Firms employing in excess of 50 persons are identified in Table 2.

In contrast to other manufacturing centers of the region, the Alton/Wood River area reflects a high degree of concentration within the non-durable goods industries (i.e., petroleum, ordnance and paper products). In comparison with the industrial characteristics of Madison County as a whole, PIWOCA planning area industries employ 20,000 or 66 percent of the manufacturing labor force, produce $325 million worth or 49 percent of the goods manufactured, and are responsible for $211 million or 67 percent of the payroll income for manufacturing employers.

Table 2
MAJOR MANUFACTURING FIRMS
PIWOCA PLANNING AREA

Name	Location	SIC	Employment
lin Corp.	East Alton	3461, 2892, 1921	5,600
wens-Illinois, Inc.	Alton/Godfrey	3221, 3541	3,900
aclede Steel Co.	Alton	3312	3,100
hell Oil Co.	Wood River	2911	2,100
lton Box Board	Alton	2651	1,000
MOCO	Wood River	2911	630
lark Oil Co.	Hartford	2911	320
uncan Foundry, Inc.	Alton	3323	320
ropellex-Chromalloy, Inc.	Edwardsville	3101	300
eavey Co.	Alton	2041	250
hemetco	Hartford	3331	200
lton Telegraph Co.	Alton	2711	200
mith & Wesson Co.	Alton	1951	180
.S. Reduction Co.	Alton	3334	160
olonial Baking Co.	Alton	2051	150
eall Mfg.	East Alton	3452	150
ichards Brick Co.	Edwardsville	2278	80
ir Reduction Co.	East Alton	2813	60
ederal Steel Co.	East Alton	3441	60

ource: Illinois Directory of Manufacturers, 1973.

The comparative productivity of manufacturing industries by community is illustrat in Plate 8. In the past five years, there have been approximately eleven major industrial expansions in the area which have resulted in the establishment of two ne manufacturing operations and nine plant expansions. These have included:

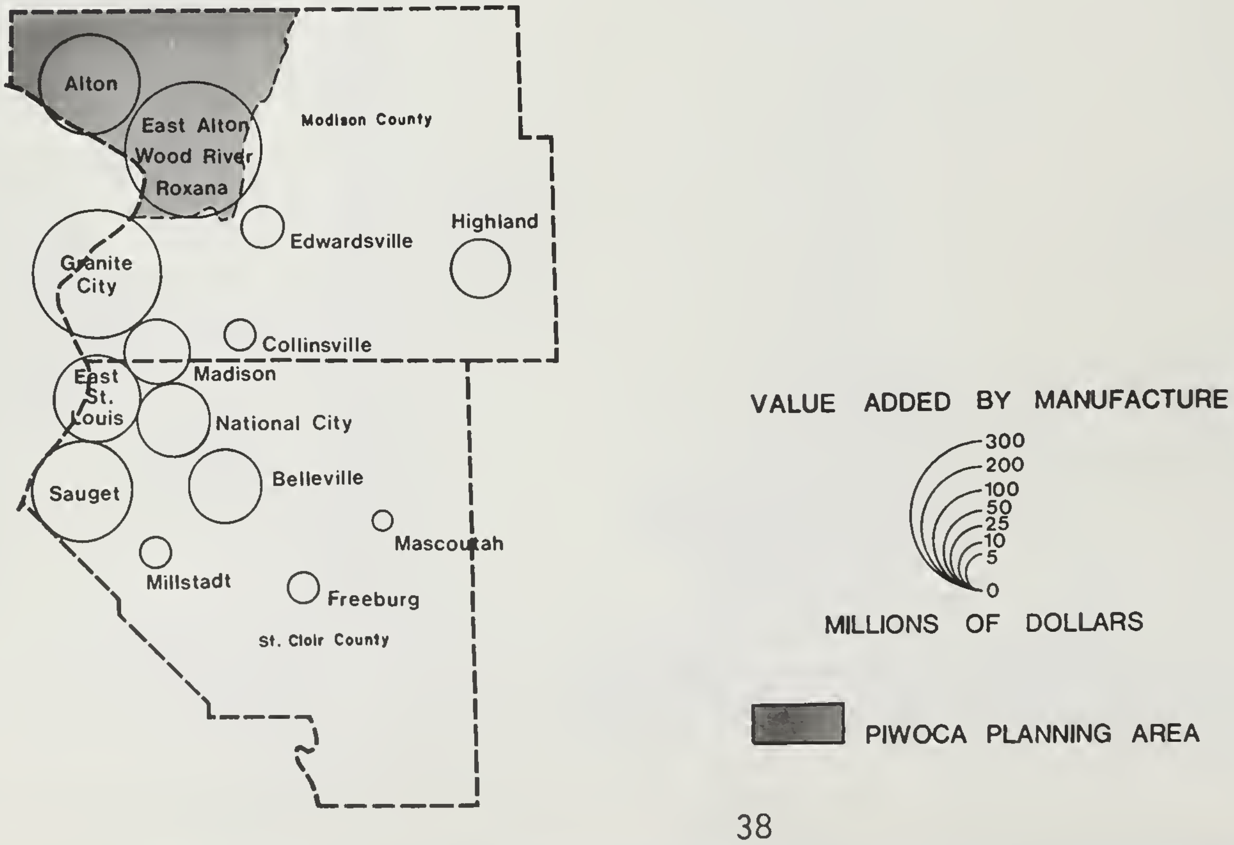
Olin Corporation - Copper alloy tube mill
- Light gauge copper rolling mill

Clark Oil Company - Refining and storage facilities
Chemetco - New plant established to electrolytically refine copper
Alton Box Board - Paper board carton folding plant
Alton Telegraph Printing Company - Building expansion
Owens-Illinois, Inc. - New selecting department building and batch plant facility
Cope Plastics - New industry, construction of building for plastic products fabrication
Shell Oil Company - Increase in refining capacity and storage capacity for crude oil and asphalt
Anlin Company of Illinois - Sulphuric acid manufacturing plant
AMOCO - Construction of new petroleum chemical additive plant and sulphur extraction unit
Laclede Steel Company - Expansion of steel production capacity

PLATE

Distribution of Production by Manufacturing Industries 196

MADISON AND ST. CLAIR COUNTI



griculture: In the PIWOCA planning area, well over one-half of the total area is tilized for agriculture. This area is under the management of 790 farms and con- ributes a large amount to the total economy of the area. The agricultural economy f the area is based on both livestock and cash crop farming, with major crops being orn, soybeans, and wheat. The livestock population is predominantly cattle and wine.

ne most recent data (1974) is analyzed on the township level of aggregation. Where pplicable, recent county-level and state-level characteristics are cited for com- arison. The following townships, either in whole or in part, constitute the PIWOCA anning area:

Alton	Fort Russell
Godfrey	Wood River
Foster	Edwardsville (part)
Omphghent (part)	Moro
Hamel (part)	

riculture has been important in the planning area throughout its history. In 1974 ere were 790 farms in the area with an average size of slightly over 138 acres.

Table 3
AGRICULTURAL LAND UTILIZATION
PIWOCA PLANNING AREA

Area	Total Land Area	No. of Farms	Land in Farms	Average Size of Farms	Land Use %		
					Crops	Pasture	Other
wnships:							
Alton	4,480	0	-	-	-	-	-
Edwardsville	22,784	79	11,527	146	73	8	19
Fort Russell	24,064	91	21,150	232	76	10	14
Foster	21,120	147	13,701	93	59	18	23
Godfrey	21,824	124	10,536	85	54	11	35
Hamel	23,744	158	21,626	137	75	14	11
Moro	21,184	81	13,902	172	70	19	11
Omphghent	21,632	97	14,374	148	65	26	9
Wood River	19,072	15	2,474	165	71	11	18
WOCA Planning Area	179,804	790	109,290	138	68	15	17
dison County	467,840	2,103	329,548	157	76	10	14

urce: Illinois Department of Agriculture, Bureau of Agriculture Statistics, Annual Farm Census, 1974.

Table 4
CROP PATTERNS
PIWOCA PLANNING AREA

Area	Total Cropland	% Corn	% Wheat	% Soybeans	Other Crops
Townships:					
Alton	0	-	-	-	-
Edwardsville	8,415	22	18	57	3
Fort Russell	16,074	39	15	37	9
Foster	8,084	31	20	34	15
Godfrey	5,689	27	24	34	15
Hamel	16,220	30	15	44	11
Moro	9,731	32	15	37	16
Omphghent	9,343	32	15	40	13
Wood River	1,757	15	21	56	8
PIWOCA Planning Area	74,317	29	18	42	11
Madison County	250,456	29	18	44	9

Source: Illinois Department of Agriculture, Bureau of Agriculture Statistics, Annual Farm Census, 1974.

Table 5
LIVESTOCK CHARACTERISTICS
PIWOCA PLANNING AREA

	Number of Livestock on Farms			Number of Farms Reporting Various Species			
Area	Cattle	Milk Cows	Hogs	Cattle	Milk Cows	Hogs	Poultry
Townships:							
Godfrey	232	65	681	24	9	9	0
Wood River	0	0	0	25	13	0	0
Edwardsville	110	0	168	16	0	5	0
Foster	414	17	2,585	39	3	19	13
Moro	391	175	4,627	43	17	31	26
Omphghent	517	18	3,008	41	3	50	5
Fort Russell	445	525	8,518	31	13	31	13
Hamel	527	641	4,805	51	23	41	34
Madison County	7,139	5,706	73,992	582	213	467	206

Source: Illinois Department of Agriculture, Bureau of Agriculture Statistics, Annual Farm Census, 1974.

)f the total land area of 179,904 acres, approximately 109,290 acres or 61 percent f the land area is farmed. Of the total acreage farmed, 74,317 acres (68 percent) re used for crop production; 16,394 acres (15 percent) are used for pasture; and 8,579 acres (17 prcent) for other farm purposes (Table 3).

he major crops produced in the PIWOCA planning area are cash grains which include oybeans (42 percent of cropland area), corn (29 percent of cropland area), and heat (18 percent of cropland area). Other crops produced include alfalfa, hay arley and oats (Table 4).

ariations in crop productivity per acre are generally related to soil and drainage haracteristics within the area.

he value of livestock production on farms within the PIWOCA planning area generally quals or exceeds the value of crop production. Table 5 illustrates the patterns f livestock production within the planning area.

n 1969, farms in the PIWOCA planning area produced approximately $10 million worth f crops and livestock products.

ining: The only significant mining activity within the area is associated directly ith the supply of construction and industrial process materials. Limestone quarry- ng is carried out in the vicinity of the Mississippi River bluffs at Alton and odfrey. Clay, for the manufacture of bricks and tiles, is extracted from deposits ocated north of Edwardsville and Alton. Molding sand, for industrial processes, is redged from the Mississippi River near Alton. Although production value statistics re not available specifically for the study area, it is estimated that the greater art of Madison County's annual production of $4 million comes from the planning rea. Approximately 230 persons are employed in mining operations within the PIWOCA rea.

ne recent resurgence in coal resource development may affect the area. The eastern ortion of the PIWOCA planning area is underlain by extensive reserves of Herrin lo. 6) coal. Reserves generally average 7 to 8 million tons per square mile in eams over 42 inches thick. Only limited areas have been mined out in the past-- otably in the Fosterburg and Williamson/Livingston vicinities.

ne prospects of establishing a coal-based synthetic fuel facility in the area in ne future are strong. The extensive coal reserves and available water supplies of ne Mississippi River (9 billion gpd at Alton) together provide the necessary ele- ents for such a facility. In 1975, the State of Illinois considered a site in the cinity of Dorsey for the accommodation of the Coalcon Project. The project, onsored by ERDA, Illinois and Coalcon, was eventually located at New Athens, linois, after an exhaustive site search which included consideration of six states th high sulphur coal reserves.

ntract Construction: There are approximately 190 construction firms within the rea which employ approximately 1500 workers. This represents approximately 30 percent of the construction labor force in Madison County. Construction activity is closely related to industrial plan expansions, commercial facility development ing highway transportation construction. This industry group exhibits moderate seasonal fluctuations in employment and a high degree of susceptibility to recessionary influences. During the recent 1974-1975 recession, unemployment in selected trade unions in the area rose to 25 percent and higher. The greatest single anticipated influence on the area's construction industry will be the reconstruction of Alton Lock and Dam No. 26. The decision to reconstruct this facility is pending.

Transportation: The transportation industry in the PIWOCA planning area provides employment for approximately 2500 workers. Employment is concentrated within the highway transport and railway sectors of the industry. Transportation systems within the area are shown on Plate 9.

Highways: The planning area is served by an extensive network of federal, state and local highways. Interstate 270 lies immediately south of the area and Interstate 55 lies immediately to the east. Illinois Routes 3, 100, 111, 140, 267, and U.S. Route 67 serve as the area's primary transportation arteries. Routes 67 and 3 are four-lane, divided highways, and Routes 111 and 140 are partial four-lane highways.

Motor Freight Service: Highway transport services in the Planning Basins are provided by both general and specialized carriers. Table 6 identifies the common and specialized carriers within the planning area.

Table 6
MOTOR CARRIERS
PIWOCA PLANNING AREA

Common Carriers

McCoy Transfer Company
Wood River

Ohley Transfer Company
Alton

Specialized Carriers

Trans-Petro, Inc.
South Roxana

Specialized Carriers (continued)

CBW Transport Services
South Roxana

Curry Truck Company
Hartford

Ee-Jay Motor Transport Company
Hartford

Illinois-Ruan Transport Company
Wood River

PLATE 9

TRANSPOR

PIASA CREEK,

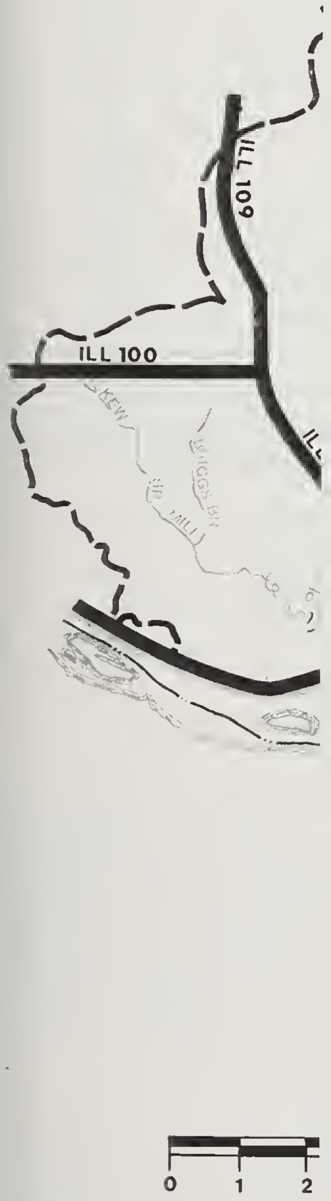


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PLATE 9

TRANSPORTATION NETWORK

PIASA CREEK, WOOD RIVER, AND CAHOKIA CREEK PLANNING BASINS

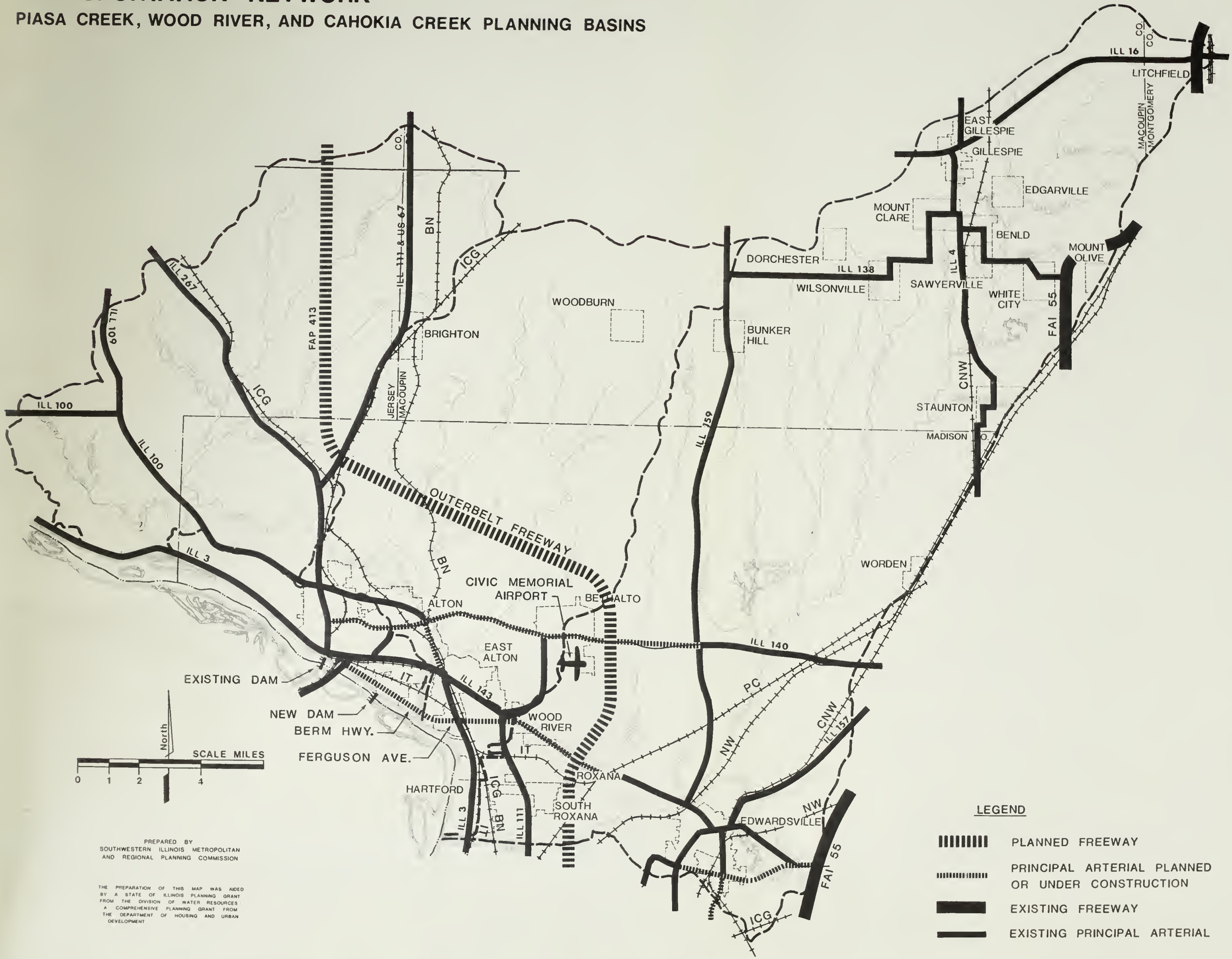

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Table 7
PORT FACILITIES
PIWOCA PLANNING AREA

Owner/Operator	River Mile	Service
Norman Brothers, Inc.	205.9	S
ADM	204.1	DB
Laclede Steel Company	204.1	GC
Mississippi Lime Company	203.9	DB
Peavey Company	203.2	DB
Alton Sand Company	202.5	DB
American Comm. Barge Line	201.8	S
Illinois Power Company	199.5	U
Stauffer Chemical Company	199.0	LB
AMOCO	198.8	LB
AMOCO	198.1	LB
Economy Boat Store	198.0	S
Shell Oil Company	197.6	LB
Clark Oil Company	197.3	LB
Ory Brothers Marine Service	197.0	S
Sioux City & New Orleans	197.0	F
National Marine	196.9	S
Marathon Pipeline Company	196.6	LB

Note: S = Service, D = Dry, L = Liquid, B = Bulk, G = General, C = Cargo, U = Utility, F = Fleeting.

Source: U.S. Army Corps of Engineers.

il Service: The PIWOCA planning area is a portion of the nation's second largest il center. Rail service in the area is provided by the Burlington Northern, linois Central Gulf, Illinois Terminal, and Penn Central Railroads. The lines terconnect with fourteen other trunk line and switching railroads within the St. uis metropolitan area. The Penn Central and Illinois Terminal Railroads maintain ur rail yards in the area. AMTRAK makes scheduled stops at Alton en route to . Louis/Chicago.

r Service: Lambert International Airport is the focus of commercial air services r the St. Louis metropolitan area. The airport is located approximately 20 miles st-southwest of Alton in the State of Missouri. Air carrier services are pro- ded by ten major airlines.

vic Memorial Airport, which is located in and adjacent to the community of thalto, serves the Alton/Wood River area. CMA has scheduled commercial passenger d freight service provided by Air Illinois.

Public Transportation: Interregional bus service within the Alton/Wood River and St. Louis metropolitan area is available on a regularly scheduled basis by the Bi-State Development Agency.

Barge Service: Eighteen privately owned and operated port facilities are located along the east bank of the Mississippi River within the planning area (Table 7). Public port facilities are available at Tri-City Regional Port District located about 10 miles south of Wood River on the Chain of Rocks Canal.

Communications: Telephone service in the Planning Basins is provided by Illinois Bell Telephone Company which maintains seven exchanges for service to the area.

There are two radio stations within the area, WOKZ (AM and FM) at Alton, and WRTH (AM and FM) at Wood River.

Communications firms within the area employ approximately 350 persons.

Utilities:

Electric Service: Electric power in the area is supplied by three companies, Union Electric Company, Illinois Power Company, and Southwestern Electric Cooperative. UE and IP are investor-owned, publicly regulated utilities which generate power, while SEC purchases electric power from IP and distributes it locally.

IP and UE generate power primarily from coal-fired thermal electric plants, one o which is located in Wood River (IP). Total generating capacities of each utility are: IP - 2.7 million KW, and UE - 6.0 million KW.

Natural Gas: Natural gas is supplied to area consumers by the two aforementioned investor-owned utilities. Both firms are restricted in terms of the number of ne connections which can be made for residential and commercial users. Natural gas i not available for new industrial processing requirements.

Water Service: The PIWOCA planning area is served in part by private and municipa water suppliers. Many of the industries located within the urban portion of the area maintain and operate single user facilities while many of the rural communities do not provide water service. The following public service water systems ar located within the area (Table 8).

In addition, there are fifteen private commercial/industrial systems and eleven public institutional systems in the area.

Table 8
WATER SYSTEMS
PIWOCA PLANNING AREA

System	Estimated Population Served	Design Capacity (MGD)	Average Daily Use (MGD)	Fire Ins. Class	Type of System*	Storage Capacity (M.Gal.)
lton	59,500	10.00	9.00	5	P	5000
ethalto	16,860	1.08	0.95	7	M	1800
ast Alton	7,300	1.50	0.85	6	M	750
dwardsville	11,500	1.61	1.12	7	M	1430
artford	2,300	0.32	0.16	7	M	100
oxana**	10,500	0.89	0.66	6	M	640
outh Roxana		(Distribution Only)		9		
ood River	14,500	3.00	1.18	6	M	750
orden	1,075	0.06	0.05	8	M	50

* M = Municipal, P = Private. ** Includes South Roxana.

ource: Southwestern Illinois Metropolitan and Regional Planning Commission.

Table 9
SEWAGE TREATMENT FACILITIES
PIWOCA PLANNING AREA

System	Estimated Population Served	Level of Treatment	Average Daily Use (MGD)	% of Drainage Capacity	Type of System*
ton	30,000	Primary	3.000	50	M
thalto	6,000	Lagoon	0.200	50	M
st Alton	7,300	Primary	0.478	41	M
wardsville	10,950	Primary	1.294	-	M
rtford	2,245	Primary	-	75	M
xana	1,880	Secondary	0.190	78	M
uth Roxana	2,360	Lagoon	-	-	M
od River	12,125	Primary	1.417	76	M

* M = Municipal.

urce: Southwestern Illinois Metropolitan and Regional Planning Commission.

Sanitary Sewer Service: As with water systems, not all communities in the planning area are served with sanitary sewers. Table 9 identifies the communities with systems.

Retail Trade: There are approximately 1,591 sales establishments within the planning area, collectively accounting for over $335 million in retail sales annually. These firms employ approximately 6,210 persons. Table 10 illustrates the retail trade patterns within the planning area and the changes which have occurred between 1964 and 1974. The City of Alton is the largest retail center in the area, accounting for about 41 percent of all retail sales in 1974. Following Alton in rank order of volume of retail are: Wood River (17 percent), Edwardsville (13 percent), East Alton (12 percent), Unincorporated Area (9 percent), and Other Communities (8 percent). Over the ten-year period, the number of retail firms in the area has declined from 1905 to 1591, a loss of 314 firms. Conversely, the volume of retail sales has increased by about 94 percent or, if adjusted (CPI deflator), about 50 percent. Despite the increasing volume of retail sales in the area, it still lags

Table 10
RETAIL TRADE PATTERNS AND TRENDS
PIWOCA PLANNING AREA

	1964		1969		1974	
	Sales*	Firms	Sales*	Firms	Sales*	Firms
Alton	79.9	713	91.1	562	138.0	546
Bethalto	2.7	88	4.9	78	8.0	83
Cottage Hills	0.9	17	1.8	20	2.9	21
Dorsey	-	2	-	-	-	1
East Alton	30.1	193	33.2	164	41.3	183
Edwardsville	22.1	263	30.0	208	44.0	223
Godfrey	1.4	30	3.7	49	7.2	48
Hartford	1.7	46	1.5	33	3.1	32
Roxana	1.2	43	1.5	31	2.1	36
South Roxana	0.3	5	1.0	15	1.2	19
Wood River	20.9	251	32.0	206	57.0	207
Worden	0.7	32	0.9	24	1.2	22
Unconsolidated	11.9	222	16.1	156	29.2	170
PIWOCA Planning Area	173.8	1,905	217.7	1,546	335.2	1,591
Madison County	340.9	3,901	418.9	3,189	677.4	3,330

* In millions of dollars.
Source: Illinois Department of Revenue.

ehind the rest of the State in terms of per capita retail sales. At the State evel, per capita retail expenditures were $3,302 in 1974. In the same year, per apita retail sales for the planning area were $2,775--$527 or 16 percent less than tate levels. Retail purchasing outside the area is the primary cause of this ituation. Recently announced plans for the construction of a regional shopping enter in the vicinity of the Beltline in Alton will undoubtedly serve to change pending patterns. Further, recent retail facility development in Edwardsville ill further serve to reduce the out-flow of retail trade dollars from the area and hereby contribute to increased employment opportunities for area residents.

holesale Trade: There are approximately 83 wholesale trade firms in the planning rea employing about 1,040 persons. The majority of these firms are engaged in upplying wholesale goods to retail firms and are concentrated within the Alton-ood River area.

inance: Financial institutions in the planning area collectively account for employment for over 500 persons. The PIWOCA area is served by ten banks and ten avings and loan institutions, which are in Table 11. Other financial institutions nclude credit union organizations and private loan companies. Totally there are 9 financial institutions/businesses in the area which employ in excess of 860 ersons.

nsurance: There are 61 insurance firms represented in the planning area. These stablishments are branch offices or agencies of larger corporate entities with eadquarter offices located out of the planning area. Employment in this industry rouping is approximately 700.

eal Estate: There are 61 real estate companies in the planning area employing approximately 300 persons. Additional personnel not considered here are real estate ales people who function as agents of a broker rather than employees of a broker.

ducational Services: Educational institutions within the PIWOCA planning area, hich include primary and secondary schools, colleges and universities, employ pproximately 2000 persons. Employment and enrollment statistics for public and rivate educational institutions are listed in Table 12.

ealth Services: There are five hospitals within the area--Alton Memorial Hospital, lton; St. Joseph's Hospital, Alton; St. Anthony's Hospital, Alton; Wood River ownship Hospital, Wood River; and the Alton State Hospital. These facilities mploy in excess of 2500 persons. In addition, other health care facilities (16) mploy an additional 1000 persons in the provision of long-term health care service.

Table 11
FINANCIAL INSTITUTIONS
PIWOCA PLANNING AREA

Name and Address	Total Deposits*	Outstandi Loan*
Alton Bank & Trust Company 620 East Broadway, Alton	$ 35,387,708	$ 23,968,2
1st National Bank & Trust Company 3rd and Belle Streets, Alton	55,982,675	24,368,4
The Bank of Alton 1520 Washington Avenue, Alton	10,430,044	6,307,2
Bethalto National Bank 101 South Prairie, Bethalto	5,213,600	2,674,3
1st National Bank of Wood River N. Wood River Avenue & W. Lorena, Wood River	32,179,369	26,402,8
Godfrey State Bank Godfrey	6,771,879	1,185,2
Illinois State Bank of East Alton Main & West St. Louis Avenue, East Alton	26,306,294	12,923,8
Metropolitan Bank and Trust Company 2900 Beltline, Alton	3,473,933	2,607,8
Edwardsville National Bank and Trust Company 100 St. Louis Road, Edwardsville	31,837,042	16,317,0
Bank of Edwardsville 330 West Vandalia, Edwardsville	28,269,017	16,628,3
Alton Savings and Loan Association 620 East Third, Alton	40,531,998	40,519,4
Citizens Savings and Loan Association 700 Berkline, East Alton	17,616,209	15,643,7
1st Federal Savings and Loan Association of East Alton 200 West Main, East Alton	18,624,517	14,652,2
Illini Federal Savings & Loan Association State and Well Streets, Alton	148,141,230	159,798,3
Germania Federal Savings and Loan Association 543 East Broadway, Alton	140,789,789	163,729,3
Home Savings and Loan Association Broadway & Piasa, Alton	27,230,877	23,025,2
Wood River Savings & Loan Association 1 East Ferguson, Wood River	11,721,709	11,148,8
1st Federal Savings & Loan of Edwardsville 300 St. Louis Road, Edwardsville	25,057,978	20,714,1
Citizens Savings 1500 Troy Road, Edwardsville	110,169,444	120,404,3
Clover Leaf Savings and Loan Association 200 East Park, Edwardsville	18,591,853	17,921,6

* Amount of deposits and outstanding loans, December 31, 1973.
** Branch office -- includes totals for home office and other branch offices.
*** Includes branch offices in Dupo, East St. Louis and O'Fallon, Illinois.

Table 12
EDUCATIONAL INSTITUTIONS
PIWOCA PLANNING AREA

Name	Number of Units	Number of Teachers	Number of Pupils
ublic			
Alton Community Unit School District 11	22	556	12,222
Bethalto Community Unit School District 8	8	139	3,604
East Alton School District 13	6	66	1,315
Edwardsville Community Unit School District 7	6	232	5,381
Roxana Community Unit School District 1	6	183	3,578
Wood River School District 15	5	54	1,184
ivate			
Marquette High School, Alton	-	22	519
Trinity Lutheran Elementary School	-	7	157
olleges and Universities			
Southern Illinois University, Edwardsville	-	500	11,000
Lewis and Clark Community College	-	200	-
SIUE, Dental School	-	40	48

urce: Illinois Superintendent for Public Instruction.

Pattern of Land Use

The complex physical landscape with its contrasting regions developed by natural forces, and the subsequent changes in the landscape resulting from man's activities in transportation and industrial development are evident in the pattern of land use found in the PIWOCA Planning Basins today. Urban centers within the PIWOCA Basins are represented by the large urban concentrations in the Alton-Wood River and Edwardsville areas located in the southwestern portion of the study area, in the American Bottoms and adjacent bluff area, and by the smaller communities scattered throughout the rural upland area. Urban growth in the American Bottoms followed the locational pattern set by transportation and industrial development, while the upland communities developed as service centers for the agricultural community, wit Edwardsville having additional growth because of its historical position as the governmental center of the area.

The three-basin PIWOCA study area is rural in nature with most of the area devoted to agriculture. Urbanization is generally concentrated along the Mississippi River in Madison County. The extensive tree cover in each of the Planning Basins is indicative of the rugged terrain.

Existing Land Uses - For the most part, urban development in the three-basin PIWOCA study area is located within established communities. The majority of these communities, both incorporated and unincorporated, are located in Madison County in the extreme southern portions of the Basins. Incorporated communities include Alton, Bethalto, East Alton, Edwardsville, Hartford, Roxana, South Roxana, Wood River and Worden. The larger unincorporated communities include Forest Homes, Cottage Hills, Rosewood Heights and Godfrey. Remaining land uses throughout the three Basins are primarily forest cover and agricultural related land uses (Plate 10).

Piasa Basin: Tree cover and agriculture account for most of the land in this watershed with only a very small portion classified as urban. Urban development which does exist is located almost entirely within Madison County in the extreme southeastern portion of the watershed.

Residential development is represented by relatively small concentrations in the southeastern portion of the watershed and scattered units throughout the watershed along the township and county road system. Almost all of the residential development is single family.

Commercial development represents a very small portion of urban development within the watershed. This development is located in the southeast portion of the watershed adjacent to the larger concentrations of residential development. There are no major industrial developments within the watershed.

Wood River Basin: Urban development in the area drained by the Wood River is primarily concentrated in and around the communities of Alton, East Alton, Bethalto and Wood River, all located in Madison County in the extreme southern portion of the watershed. The remainder of the watershed is forested or devoted to agricultural uses.

Residential development is generally located in and adjacent to the communities in the southern portion of the watershed. However, scattered residential units are found in the rural areas along the township and county road systems. One- and two-family units represent almost all of the residential development.

Commercial land uses are found along the arterial and collector streets within the communities. However, expanding shopping centers located along major traffic carriers are beginning to play an important role in land development within this watershed.

Industrial development, although it plays an important role in the area economy, represents a small part of the watershed's urban land use. The vast majority of this land is located in the extreme southern portion of the watershed, in and adjacent to the communities of Alton, East Alton, and Bethalto.

Cahokia Basin: Of the three watersheds, Cahokia Creek watershed contains the largest amount of urban land. The large majority of its urban land is located in and adjacent to the communities located in the southern portion of the watershed, in Madison County. These communities include Roxana, South Roxana and Wood River in the American Bottoms, and Edwardsville in the upland portion. The remainder of the watershed is generally in tree cover or agriculture with a small proportion in urban use.

Residential development is concentrated in and around the numerous incorporated and unincorporated communities. Almost all of the residential development is one- and two-family development; however, this watershed has considerably more multi-family complexes than the other two watersheds. Almost all the apartment complexes are strategically located along the larger communities' arterial and collector street systems.

Commercial developments are, for the most part, located along arterial and collector streets and in the Central Business Districts (CBD) of the communities. An increasing amount of commercial development has been occurring along major traffic carriers located away from the communities' CBD's and, in many cases, outside their municipal boundaries.

Industrial development represents an important element of urban land uses in the watershed. The amount of land devoted to industrial purposes in the watershed is considerably larger than the amount in the other two watersheds. Industrial development is located primarily along the southern and western edge of the contiguous urban area in the American Bottoms portion of the watershed. Oil refineries in the community of Roxana represents the largest portion of industrial land uses.

Projected Urban Land Uses - Future urban development is projected to occur primarily within and immediately adjacent to existing urbanized areas. For each of the three Basins, this would mean continued urban development in their extreme southern portions. Scattered development, however, is expected to continue throughout the rural portions of the watersheds. This development will occur primarily along township and county road systems and should be relatively minor (Plate 11).

Piasa Basin: It is anticipated that development will largely occur in the southern portion of this watershed, in and adjacent to the communities of Alton and Godfrey It is not anticipated that significant development will occur in this watershed. Much of this development will be a result of the outward expansion from the Alton and Godfrey urban developments along Illinois Highway 3 to the west and Illinois Highway 111 to the north. Low-density residential will be the predominant development throughout the watershed. Commercial development will represent only a small proportion of the watershed's growth. Commercial land uses which do develop will occur in the extreme southeastern portion of the watershed adjacent residential developments. Industrial land uses will continue to play a minor role in the development of the watershed. Industrial development which may occur would be located adjacent to the community of Alton.

Wood River Basin: Significant urban development is anticipated for the Madison County portion of this watershed. The most rapidly urbanizing areas will be in and adjacent to the communities of Alton, Godfrey, East Alton, Bethalto and Wood River. Most of this development will be in the form of low-density residential land uses expanding outwardly from the existing urban areas. Medium- and high-density residential land uses, generally, are projected to occur in proximity to the arterial street system and major activity centers. Commercial developments will occur at strategic locations with respect to the regional transportation network and higher density residential land uses. Much of the proposed commercial land uses are represented by expansion of existing developments. Proposed industrial development is represented basically by consolidation of existing development. Generally, these industrial uses are located to the south of Illinois Highway 111, 140 and adjacent to the East Fork of the Wood River.

Cahokia Basin: Urban development in this watershed will continue to occur around the communities in the southern portion of the watershed--in particular, Edwardsville, Wood River and Bethalto. Throughout the remainder of the watershed, urban development will be relatively minor and will largely occur in the town of Worden and along township and county roads. Low-density residential development is expected to occur around the major communities as the urban services, such as sewer and water, are extended into newly developing areas. Medium- and high-density residential uses will locate with respect to the regional transportation network as well as the local transportation network. Most of the higher density residential uses are expected to occur around the communities of Bethalto and Edwardsville. Commercial land use developments are anticipated to occur primaril within the central business districts of the various communities and with respect o the regional transportation network and higher density residential land uses. ndustrial development will occur, primarily, in two locations, the American Bottoms n the vicinity of Roxana, and at the Civic Memorial Airport in Bethalto. Industrial evelopment in the Bottoms will basically be a consolidation of existing development ent, while industrial development at the Civic Memorial Airport is currently in the lanning stage.

opulation

he total population of Madison County in 1970 was 250,934. Of this number, approximately 130,537 (52 percent) resided in the PIWOCA planning area. The majority of he planning area population, 85,037 (65 percent), lived in incorporated communities and the remaining 45,500 (35 percent) lived either adjacent to the communities r in the rural areas of the planning area. Population characteristics for Madison ounty, the PIWOCA planning area, and selected communities are listed in Table 13.

he major communities within the planning area, Alton, Wood River, Edwardsville, ethalto and East Alton, represent respectively 30, 10, 8, 6, and 6 percent of the otal planning area population. The distribution of population is represented by

Table 13
POPULATION CHARACTERISTICS FOR SELECTED COMMUNITIES
PIWOCA PLANNING AREA

	1970 Population	2000 Population	Percent Population Change	Median School Years Completed	Median Family Income
dwardsville	11,070	21,100	91	12.4	$11,019
lton	39,700	46,000	16	11.4	9,600
ast Alton	7,309	9,800	34	10.5	9,242
ethalto	7,332	13,000	77	12.0	10,443
ood River	13,186	19,000	44	12.1	10,021
IWOCA Planning Area	130,537	180,400	38	NA	NA
adison County	250,934	366,550	46	11.5	10,249

ource: U.S. Department of Commerce, Bureau of the Census, U.S. Census of Population, 1970; Southwestern Illinois Metropolitan and Regional Planning Commission.

a strong northwest-southeast distribution of population concentrations within the planning area. To the northwest is the Alton-Wood River area which accounts for almost 66 percent of the planning area's population and to the southeast is the community of Edwardsville and its adjacent population which occounts for approximately 10 percent of the population. The remainder of the planning area's population is scattered throughout, primarily along the state and county roads. In relationship to Piasa Creek, Wood River, and Cahokia Creek, the Alton-Wood River area, which is almost bisected by the Wood River, is the only major center of population located adjacent to a major creek. This area, however, represents the single largest concentration of population throughout the PIWOCA area.

Population projections to the year 2000 indicate that population distribution will continue in the dominant northwest-southeast alignment. Edwardsville will experience the largest rate of increase (91 percent), although communities in the Alton-Wood River area will also realize significant population increases. The Alton-Wood River area will continue to be the largest population center, while Edwardsville will remain the dominant population center in the southeast. It is anticipated that the remainder of the planning area will maintain its rural character with only slight population increases.

Census data for the major communities in the PIWOCA planning area show Edwardsvill with both a higher median family income ($11,019) and a higher median school years completed (12.4) than the communities in the Alton-Wood River area. In comparison to census data for the entire county, Edwardsville is significantly higher in both categories, while communities in the Alton-Wood River area compare less favorably. In the Alton-Wood River area, data for median school years completed range from a low of 10.5 in East Alton to a high of 12.1 in Wood River, while data for median family income range from a low of $9,242 in East Alton to a high of $10,443 in Bethalto. For the most part, it can be expected that both the income level and educational level of the larger communities is higher than the rural areas of the planning area. Generally, there is a tendency for rural areas to have both lower levels of educational attainment and a lower level of income.

Selected housing characteristics for Madison County and the major communities in the PIWOCA planning area are illustrated in Table 14. In 1970, there was a total of 82,225 housing units in the county of which 67 percent were classified as owner occupied. The occupancy ratio was 3.1, the median number of rooms was 4.6, and th median value of homes was $13,900. Census data for the major communities show a slight range in all categories. The median value of homes in Edwardsville was a relatively high $15,900 with 73 percent of the homes owner-occupied. The occupancy ratio, 2.9, and median number of rooms, 4.8, for Edwardsville homes is slightly better than the county's 3.1 and 4.6, respectively. In the Alton-Wood River area, the median value of homes and percent owner-occupied ranges from a low of $11,100 and 60 percent, respectively, in East Alton to a high of $14,700 and 75 percent, respectively, in Bethalto. Both the occupancy ratio and the median number of rooms for communities in the Alton-Wood River area approximate the county figur of 3.1 and 4.6, respectively.

Table 14
HOUSING CHARACTERISTICS FOR SELECTED COMMUNITIES
PIWOCA PLANNING AREA

	Median Value of Homes	Total Housing Units	Percent Owner Occupied	Occupancy Ratio	Median No. of Rooms
lwardsville	$15,900	3,871	73	2.9	4.8
ton	12,500	13,968	63	3.0	4.6
st Alton	11,100	2,737	60	2.8	4.1
thalto	14,700	2,282	75	3.2	4.5
od River	12,800	4,708	68	2.9	4.4
dison Co.	13,900	82,225	67	3.1	4.6

urce: U.S. Department of Commerce, Bureau of the Census, U.S. Census of Population, 1970.

ULTURAL AND ECOLOGICAL CHARACTERISTICS

n recent years environmental considerations have become an important aspect of
ater resource management planning. Evidence of this appears in the number of
ater-oriented projects being reviewed by the courts today because of alleged en-
ironmental constraints. The physical, social, economic and hydrologic components
f the environment are dealt with elsewhere in this chapter. The historical, cul-
ural and ecological components are discussed below.

rcheology

ne Piasa Creek, Wood River, and Cahokia Creek Planning Basins include important
reas of prehistoric Indian culture. The area has been occupied by humans for
nousands of years and many remnants of past cultures have survived. The nearby
resence of the Koster and Cahokia Mounds sites, two of the most important arche-
logical sites north of Mexico, is an indication of the archeological importance
f the study area.

istribution and Patterns of Archeological Sites - The archeological record in
ne study area is incomplete. Many sites have been destroyed by construction for
rban uses or for agricultural activities; many others have been lightly surveyed.
etailed surveys have been conducted only along Upper Cahokia and Indian Creeks and

on the Wood River Terrace area. Nevertheless, with the utilization of records of the Illinois Archeological Survey and the educated guesses of knowledgable archeologists, the spatial distribution of the archeological sites can be described. Analysis of the distribution indicates the clustering of sites in two general zones:

1. Wood River Terrace and western periphery of the uplands.

2. Along the major creeks.

The most important sites are located on the Wood River Terrace and the western periphery of the uplands. This location was advantageous for prehistoric peoples with respect to its security from flooding and its proximity to a variety of natural environments which facilitated obtaining basic materials needs. The second most important zone is along the major creeks and derived much of its site attraction from the creeks themselves. The creeks provided easy access to the bottoms and aquatic food supplies. Plate 12 shows the location of these generalized zones of archeological site concentration.

Periods of Prehistoric Indian Culture - Archeologists classify prehistoric Indian cultures into broad categories called periods. These are distinguished on the basis of significant cultural differences. The periods sometimes overlap and distinction between one culture and another may not be sharp. Archeologists reconstruct and analyze past cultures primarily from the examination of artifacts painstakingly excavated at archeological sites.

The Indian prehistory of the study area can be divided into four major periods which span from before 8000 B.C. to about 1500 A.D. These periods generally correspond with periods of prehistoric culture throughout the Midwestern United States. The Koster site, located in the Illinois valley north of the study area, is unique because of the presence of successive cultural strata at one location. Human history is recorded there from 6000 B.C. to 1200 A.D.

The following paragraphs briefly discuss each of the periods of Indian prehistory and the location and relative importance of each period's archeological sites withi the study area.

Paleo Period (pre-8000 B.C.): The presence of scattered artifacts such as clovis points indicate that Indians lived in the study area before the retreat of the Wisconsinan glacier. These hunters and gatherers were apparently present in extremely low densities and lived in temporary settlements. To date, no archeologica sites from the Paleo Period have been found within the study area.

Archaic Period (8000 B.C. - 2500 B.C.): The Indian population during the Archaic Period, as in the Paleo Period, depended on hunting and collecting seeds and plants for their livelihood. As the climate warmed in the post-glacial period, population density and the number of associated settlements increased. Villages and camps during the Archaic Period were vary small and inhabited by transient bands. Archaic

ites are primarily located along creeks in the uplands and on the Wood River
errace.

rly and Middle Woodland Period (2500 B.C. - 500 A.D.): During these periods,
ome of the Indian population of the basins adopted agriculture and became increas-
ngly dependent on it for their foood supply. Indian culture became more complex
nd was marked by more elaborate social and ceremonial structures. During the
iddle Woodland Period the inhabitants of the study area developed sophisticated
raft skills and engaged in extensive trading activities. Middle Woodland sites
re characterized by the presence of indigenously produced pottery and imported
oods made of such exotic materials as conch shells and obsidian. Large burial
ounds were built but villages remained small and often were located close to a
urial mound. Early and Middle Woodland Village sites tend to be concentrated on
he Wood River Terrace while campsites are located in upland areas.

ate Woodland Period (Circa 700 A.D. - 1200 A.D.): This period was initially
arked by a decline in the culture of the Middle Woodland Period. This decline was
ollowed by the evolution of the first real urbanization which characterized the
ississippian period. During the Late Woodland Period, agriculture became increas-
ngly important and many Late Woodland camps were apparently used in connection
ith farming. Late Woodland sites are located in the major areas of archeological
ite concentration.

ississippian Period (Circa 900 A.D. - 1500 A.D.): During the Mississippian Period,
ndian culture became highly sophisticated and its society highly structured. The
evelopment of the City of Cahokia south of the study area is indicative of this
tatement. Cahokia Mounds represents the largest prehistoric site north of Mexico.
t the Cahokia site, a permanent city of about 6 square miles and more than 30,000
eople developed. The City of Cahokia included massive earth mounds, a 12 to 15
oot high pallisade and an elaborate sun calendar used to predict the changing
easons. Artifacts, such as pottery associated with this and other Mississippian
ites, indicate a sophisticated material culture.

he Cahokia urban center became the focus for the Mississippian culture in a large
egion. Satellite communities developed at East St. Louis, Mitchell, Dupo, St.
ouis and Lebanon. Lesser satellite communities developed throughout the study
rea and especially on the Wood River Terrace. The major Mississippian centers
ere largely supported by agriculture and hunting. Many of the smaller 1 to 5 acre
ites appear to be farmsteads while archeological evidence indicates that the vil-
ages were centers for hunting activities.

he origins and reasons for the decline of Mississippian culture in the study area
re not fully known. Some archeologists believe that major elements of
ississippian culture diffused from central Mexico due to cultural similarities
hat include platform mounds and effigy pottery. They also argue that these cul-
ural elements occurred earlier in the Gulf states and were adopted and modified
y Late Woodland people which resulted in the development of a new culture.

Table 15
HISTORIC STIES
PIWOCA PLANNING AREA

Map Reference	Locality	Site	Date
A	Alton	Confederate Cemetery	1862-65
		Post House	1837-38
		Peter Wise House	1859-65
		Old Cathedral	1855
		Captain William Leyhe House	ca. 1870
		John M. Altoff House	ca. 1841
		Anna B. Sparks House	ca. 1835-4
		Edward Goulding House	1859-65
		Mitchell House	after 1837
		Sabastian Wise House	ca.
		Carroll House	1838-40
		Keating House	1835-50
		Alton Penitentiary*	1833
		Drury & Wood Co. Building	before 186
		Lincoln Hotel	1841
		Mansion House	1834
		Dr. Charles Davis House	ca. 1847
		Col. Samuel Buckmaster House	1835-50
		E. Trenchery House	ca. 1835
		Charles Wise House	1852
		Synder Block	late 1800'
		McPike House	1869
		Guertler House*	1830
		Moses Atwood House	1852
		Col. Stephen H. Long House	before 186
		Haskell House*	late 1800'
		Sen. Lyman Trumbull House*	before 184
		Turner Hall	1867
		Lovejoy Monument	1837
		Western Military Academy	1879
		Timmermiere Residence	early 1800
		Loomis Hall	1832
		Old Rock House	1834-35
		Lincoln Douglas Debate Marker	
B	Godfrey	Godfrey House	1831-33
		The Evergreens	1854
		Monticello College	1835
		Benjamin Godfrey Memorial Chapel	1854
C	Fosterburg Vicinity	E. Rink House	
		Culp House	
		Brick Barn	
		Little Brick Barn	
D	Edwardsville and Vicinity	Kirkpatrick Cabin	1805-18
		Church of Christ	before 187
		Wabash Hotel	before 186
		Madison County Historical Museum	1836
		Matthew Gillespie House	
		John Todd House	before 185
		Madison County Jail	1867
		Madison County Courthouse	1915
		Deneen House	
		W. Brink House	
		Hadley House	1876
		Ralph D. Griffin House	1906
		Edwardsville Public Library	1903
		Benjamin Stephenson House	1819
		Three Mile Stage Stop	
		Mont Station Farm	before 187
E	Bethalto	Bethalto Jaycees Building	
		Double House	
F	Wood River	Lewis and Clark Marker	

* Listed in the National Register.

Source: "Inventory of Historic Landmarks in Madison County, Interim Report," prepared by the Illinois Historic Landmarks Survey, May, 1974.

PLATE 12

CULTURAL

PIASA CREEK,

SOUTHWES
AND REG

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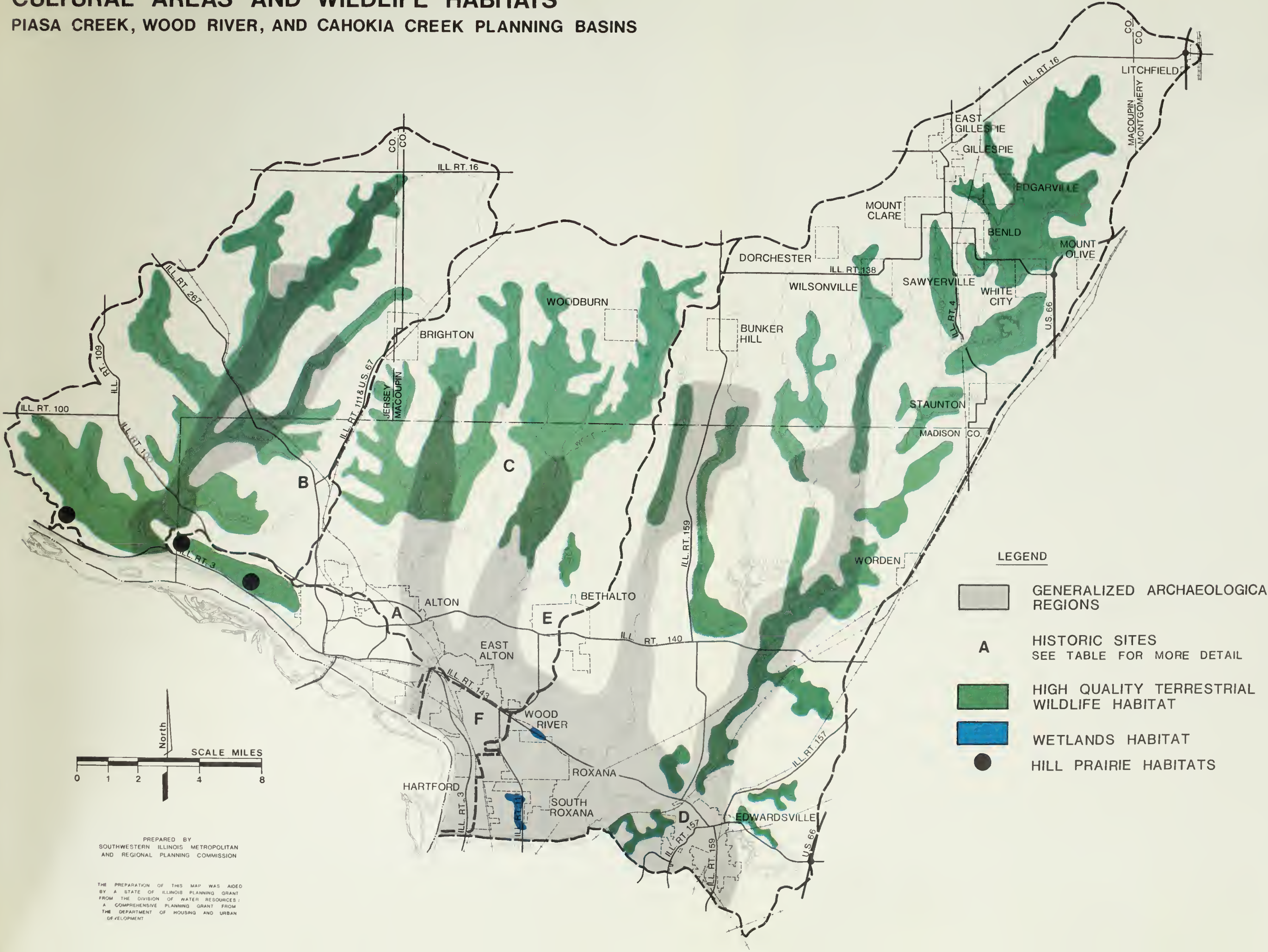
PLATE 12

CULTURAL AREAS AND WILDLIFE HABITATS

PIASA CREEK, WOOD RIVER, AND CAHOKIA CREEK PLANNING BASINS



PREPARED BY
SOUTHWESTERN ILLINOIS METROPOLITAN
AND REGIONAL PLANNING COMMISSION

THE PREPARATION OF THIS MAP WAS AIDED BY A STATE OF ILLINOIS PLANNING GRANT FROM THE DIVISION OF WATER RESOURCES; A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT pparently, both Late Woodland and Mississippian cultures existed simultaneously in he study area during the period when Mississippian cultural development reached ts apogee. Around 1250 A.D., Mississippian culture and Cahokia began to decline. xplanations for this decline include: hostile pressure from Late Woodland peoples, rop failure relating to changing climates, and over-exploitation of the natural esource base. Whatever the explanation, much remains to be learned about ississippian and earlier prehistoric cultures before these cultures can be thorughly understood.

ore than 100 years of archeological work in the study area and its vicinity has roduced a considerable body of information about the prehistoric cultures of the egion. Unfortunately, as soon as old questions are answered new questions appear. he answer to these and future questions may be extracted by the study of informaion gleaned from the archeological sites in the study area and the surrounding egion.

istoric Sites

istoric sites are important symbols of the area's cultural heritage. They remind ontemporary residents that the appearance of their area developed as a result of ong periods of change and through the efforts of people with diverse cultural ackgrounds. Historic sites are also important esthetically. Often they were nique structures carefully built by skilled architects and craftsman and stand out rom the more mass-produced structures of later years. Finally, historic sites ave economic value as a generator of tourist dollars and as an important component f an area's total environmental quality. It is a portion of the environment that leases and attracts employers and employees alike.

he PIWOCA study area has a rich historical heritage dating from the earliest uropean exploration in the area. French explorers such as Marquette and Jolliet isited the area. After 1765, Illinois came under the jurisdiction of the British nd then was transferred to the United States after the Revolutionary War. Lewis nd Clark on their expedition departed from the area. This event is commemorated y an historic marker in Wood River. The first towns in the study area were ounded early in the century. A number of buildings survive from this period. In dwardsville, the oldest town in the study area, is found a log house thought to e built by Thomas Kirkpatrick, the town's first settler. The Timmermiere resience in Alton dates from the early 1800's. The study area's population grew lowly during the 19th century, increased after the War of 1812, and picked up with he influx of Americans from other regions and Europeans after 1830. Many old omes from the 19th century show the influence of European architectural styles pon American house types. During the middle 19th century, railroads were built in he study area, coal mining developed, manufacturing increased and cities grew. he present-day runs of the Alton Penitentiary commemorate its use as a general rison after its founding in 1833 and its use as an infamous military prison during he Civil War. In the latter part of the 19th century and into the early 20th entury, the study area developed its present mix of industrial, urban and rural andscapes. Numerous Victorian and post-Victorian structures still exist from this eriod.

The major historic sites within the study area are located on Plate 12 and listed in Table 16. These sites are predominantly located in urban areas and were built during a period of more than 100 years. The historic sites include more than 35 present and former homes, institutional structures, several churches and commercial structures, and a number of monuments. The Haskell Playhouse, Guertler House, Lyman Trumbull House and the Alton Military Prison are listed in the National Register.

Plants and Animals

The Planning Basins exhibit a considerable variety of plants and animals. Althoug worthy of study by themselves, ecologists consider these organisms in interrelated units called communities. The immediate natural environment (the place where it lives) of an organism or community is a habitat.

The habitats of the three Basins can be divided into terrestrial and fresh water habitats and an intermediate habitat--marshland. The creation and management of healthy and productive habitats are increasingly viewed among ecologists as one of the key aspects of fish and wildlife management. Habitat diversity is an importan measure of habitat productivity. As diversity within and among habitats is diminished, the biotic resources of an area suffer. The following paragraphs briefly summarize the major characteristics of the habitats found in the PIWOCA study area Important habitats are delineated on Plate 12.

Rare and endangered animals are included for each habitat where information is available. A rare animal is a species or subspecies whose range in Illinois is restricted or found in small numbers within the state. An endangered species or subspecies is one in danger of not surviving in the state. Rare and endangered animals represent a unique component of their communities. Table 16 lists the rar and endangered animals for each habitat within the Basins.

Large river habitat is represented by the Mississippi River which adjoins the stud area. The river's form has been modified by man for both flood control and navigational purposes and the water quality has been degraded. These changes have resulted in a deterioration in the quality of habitat in the river.

A variety of invertebrates and vertebrates inhabit the river. Bottom detritus feeders such as crayfish and various worms are the most common invertebrates. The fish are characteristic of the Big River Faunal Group.[3] The fish species in the river include a number of fish of both commercial and sport value such as: channe catfish, freshwater drum and carp. Several species, including the once commerciall important lake sturgeon, have declined because of over-fishing and the deteriorating quality of their habitat.

Vertebrates, excluding fish, are suited to terrestrial and aquatic habitats. Foremost in this category are birds which include migratory water fowl, gulls and shor birds. Two endangered birds, the osprey and bald eagle, feed on fish in the river

Table 16
RARE AND ENDANGERED SPECIES
PIWOCA PLANNING AREA

Birds

erican Bittern - marsh (summer)

ttle Blue Heron - large river, marsh, pond, lake (summer)

ack Crowned Night Heron - marsh, lake (summer)

ld Eagle - large river (winter)

rsh Hawk - marsh, old field (winter)

per's Hawk - forest

d-shouldered Hawk - forest

regrine Falcon - old field, pasture

rn Owl - old field, forest

ng-eared Owl - forest

rt-eared Owl - pasture (winter)

land Plover - cultivated field, pasture (summer)

rster's Tern - lake, large river (migrant)

mon Tern - lake, large river (migrant)

llow-bellied Sapsucker - forest (winter)

d-breasted Nuthatch - forest

wn Creeper - forest (winter)

ggerhead Shrike - cultivated field, pasture

litary Vireo - forest (migrant)

shville Warbler - forest (summer)

ne Warbler - forest, old field (summer)

ewer's Blackbird - pasture, prairie (winter)

ery - forest (migrant)

Conte's Sparrow - cultivated field, pasture (winter)

ay-colored Sparrow - cultivated field, pasture

ntail - large river, pond, cultivated field

veler - large river, marsh, stream (migrant)

nvasback - large river, marsh, stream (migrant)

uble-crested Cormorant - large river

Mammals

Southeastern Shrew - forest, old field

Gray Bat - limestone caves, forest

Indiana Bat - limestone caves, forest

Golden Mouse - cultivated field, pasture

Plains Pocket Gopher - cultivated field, pasture, old field, prairie

White Squirrel - forest

River Otter - large river

Bobcat - forest

Amphibians

Dark-sided Salamander - stream, forest

Eastern Wood Frog - forest marsh

Reptiles

Alligator Snapping Turtle - river, stream, marsh

Hieroglyphic Turtle - large river

Western Slender Glass Lizard - forest, old field

Great Plains Ratsnake - bluff forest, prairie

Northern Flat-headed Snake - bluff forest, prairie

Western Worm Snake - forest

Timber Rattlesnake - forest

Fish

Lake Sturgeon - large river

Pallid Sturgeon - large river

Alligator Gar - large river

Alabama Gar - large river

Sturgeon Chub - large river

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urce: All animals in this compilation are included in Rare and Endangered Vertebrates of Illinois compiled by the Illinois Nature Preserve Commission, 1971, Several species of amphibians and reptiles are found in the river. Bull frogs, western painted turtle, and water snakes are typical of large river habitat. Mammals found in areas of quieter water include the muskrat, beaver and the rare river otter.

Continuous flow and intermittent stream habitats within the study area are considered jointly in this section. They fluctuate seasonally and except for the lower portions of Piasa Creek, Wood River and Cahokia Creek are technically intermittent. In extremely low-flow years all the streams within the study area are almost dry. When streams are very low, biological conditions must be able to survive low oxygen conditions. Excessive silt and municipal and industrial water pollution are two additional problems characteristic of the streams within the three Basins. Excessive silt may smother invertebrates, cover fish nesting sites and kill plants. Municipal and industrial pollution alters the species composition of streams. A recent Illinois Department of Conservation survey of the Wood River and its tributaries clearly showed that tolerant species increased in number and intolerant species decreased under polluted conditions.

Invertebrates are represented by detritus feeding insects, annelids, molluscs, flatworms and crustaceans. Fish present in the streams of the PIWOCA study area are primarily in the Prairie, Ozark-Prairie and Wide Ranging species groups. A number of amphibians such as the rare dark-sided salamander and reptiles such as the stinkpot turtle are found in the streams of the Planning Basins. In addition, a number of waterbirds, small mammals and an occasional deer are found along the streams of the study area.

Drainage ditches offer poor habitat conditions because they fluctuate greatly in flow and clarity, lack varied and stable bottoms and their water is usually low in oxygen. Plankton populations are low and invertebrates are characteristic of polluted streams in the area. Fish populations are primarily represented by the hardy wide-ranging species of buffalo and shiners.

Large lake habitat is defined as all lakes over 100 acres. This habitat is represented in the study area by Holiday Shores Lake, a 430-acre impoundment. The lake has been developed as the focus of a residential community and has suffered from pollution problems. Nevertheless, the lake supports a variety of plant and animal life. Plants found in the lake include emergent plants in shallow areas and filamentous algae in deeper waters. Worms and midges are important invertebrates and a number of species of frogs, turtles and snakes represent the amphibian and reptile populations. Migratory waterfowl, wading birds and small mammals feed at the lake. The fish belong to the wide-ranging species classification and are represented by large-mouth bass, bluegill, redear and green sunfish, black bullhead, golden shiner and white sucker.

Small lake habitat and pond habitat include all those small bodies of standing water of less than 100 acres. There are a number of small lakes ranging in size from 6 to 100 acres and many ponds less than 6 acres within the study area.

Plant and animal life varies among and within the small lakes. As in large lakes, emergent plants such as arroweed are found in shallow areas while in deeper water reas algae is more common. Worms and midge larvae predominate among the inverte- rates and a number of amphibians and reptiles are also found in small lakes and onds. Several frog species and several water snakes are common. Fish are mainly f the wide-ranging faunal group with largemouth bass, bluegill and channel catfish s the common species. Ponds and lakes are excellent habitats for migratory water- owl and wading birds. Small mammals such as the muskrat and its predator the mink ake their homes there.

arshland in the PIWOCA study area is primarily represented by an area of less than 00 acres located in the American Bottoms. Although marshlands have decreased in he area, they remain vital to flood plain ecology and are extremely valuable wild- ife habitat. Emergent flowering plants dominate the marsh plants (i.e., cattails, edges, smartweed and bur-weed are the most important of these plants. Insects such s dragonflies are also important while amphibians and reptiles are numerous. horus frogs, toads and garter snakes are characteristic of marshlands. The rare astern wood frog and the endangered alligator snapping turtle may be found in the tudy area. Due to the unreliable water supply, only a few species of small fish ive in this habitat.

arshes are important habitats for birds and mammals. Migratory ducks nest and eed there and such rare Illinois birds as the marsh hawk and the little blue heron requent marshes. Several duck species including blue winged teal, mallards and oots nest in marshes in this region. Muskrats and mink are the most important mall mammals found in the wetlands of the PIWOCA study area.

orested habitats are subdivided according to density into dense and open forests. pen forests are forested areas with less than 50 percent of their area in tree over. According to species composition, both dense and open forests can be clas- ified into flood plain and upland forest. Cottonwood, silver maple, willow, elm nd sycamore are important flood plain species and are characteristic of the merican Bottom forests and forests along the major streams in the uplands. Willows ften occupy the wettest and most precarious sites among the flood plain species. n slightly better-drained areas, cottonwoods compete successfully with the willows. lm, silver maple and sycamore prosper once a forest is established. The upland orests differ according to moisture and temperature variations. On wetter or ooler sites, white oaks and northern red oaks dominate among a scattering of other pecies. Drier and warmer sites have a mixture of oaks and hickories. Upland orests dominate most of the upland area outside of stream flood plains and banks.

ense forests support a varied biota. At the bottom of the animal food chain is a iverse array of invertebrates whose major function is to help break down the egetative material of the forest. Amphibians include the spotted salamander and he rare dark-sided salamander as well as the eastern wood frog. A number of snake pecies are represented in forest habitats. Birds are plentiful with woodpeckers eing especially numerous. A number of rare Illinois birds such as the Nashville arbler and the brown creeper live in dense forests. Mammals include deer, fox, oodcheck, raccoon, short-tailed shrew and several species of squirrels. The en- angered bobcat is possibly found in the dense forests of the three-basin area.

Open forests are usually transition area between fields and dense forests but may also include orchards and parks. Many types of grasses, sedges and weeds are present as understory plants. A number of these help provide good food and cover for wildlife. Open forests are home for deer and the heavily hunted bobwhite quail Small mammals include: woodchucks, squirrels, grey foxes, and opossums. Birds are found in open forest habitat and are also residents of dense forests and more open habitats.

Prairie in the PIWOCA study area is located in small patches along the bluffs. These remnants survived because their sites are topographically and edaphically unsuited for most economic activity. Hill prairies are dominated by a mixture of prairie grasses such as little bluestem and side-oats grama. Unfortunately, little information is available concerning hill prairie animal species. Among those species characteristic of open forest and pasture habitats, the hill prairies may be home to the rare plains pocket gopher and the northern flat-headed snake.

Pasture habitats are planted grasslands used for domesticated livestock. Pastures can provide adequate wildlife habitat if their carrying capacity is not exceeded and there is good cover and water located nearby. Pastures usually support a variety of insects, amphibians, reptiles and mammals. Pastures can provide good habitat for quail and rabbits. An endangered Illinois bird, the upland plover, is likely to be found in pasture habitat.

Cultivated fields are usually not very productive wildlife habitats during the growing season although they may serve as cover and feeding areas for some animals. After the harvest, birds and small mammals feed on the grain stubble and other material not collected in the harvest. Fall plowing, a common farming practice in the study area, renders cultivated fields virtually worthless as animal habitat during a large portion of the year.

Old field habitats are lands in early transition from pasture or cultivated field to another plant community. In the PIWOCA study area, they will usually develop into forests. Old fields are rich in weed species, grasses and small trees. Species differ according to the length of time a field has been abandoned, proximit to seed sources, and local environmental conditions. Old fields provide superior wildlife habitat for many invertebrates and vertebrates. They are usually rich in birdlife, rodents and their predators.

Terrestrial ditch habitat is confined to the borders of drainage ditches in the study area. Its best representation is along the Cahokia Diversion Channel. This habitat is often subject to periodic mowing which maintains vegetation similar to old fields. In some cases, as along some areas of the Cahokia Diversion Channel, young flood plain forests have become established. Animal life is usually similar to that found in old field habitats.

Suburban habitats are located in moderate- to low-density residential, commercial and light industrial areas. Much of the Godfrey-Alton-Wood River urban area and the Edwardsville area would be classified as suburban habitat. These habitats are characterized by a predominance of planted grass lawns and scattered shade trees. The trees consist of indigenous species as well as exotic ornamentals. Animal life

onsists primarily of those species most adaptable to close habitation with humans.
irds, such as the robin and bluejay, and mammals, such as the cottontail rabbit
nd the raccoon, thrive in suburban habitats. Suburban habitats could be consider-
bly improved through judicious management and planning by both residents and build-
rs and specifically by implementing the following measures: planting seed and
ruit-bearing trees and shrubs as a food source; preserving small wild areas of
rushes and brambles to be used for animal cover; building houses so as to limit
esting areas for unwanted species such as starlings; controlling domestic pets and
reventing them from preying on valued small birds and mammals.

entral urban habitat is characterized by a predominance of man-made structures
uch as buildings, roads and parking lots. The central business districts and
eavy industrial areas of the PIWOCA planning area are included in this category.
lants and animal species in this habitat must tolerate adverse environmental con-
itions. Animals include only the most adaptable species such as pigeons, star-
ings and rats.

YDROLOGIC CHARACTERISTICS

urface Water

ne three Planning Basins drain into the Mississippi River via their major streams.
iasa Creek, with a drainage area of 22 square miles within the PIWOCA planning
rea, flows across extreme northwest Madison County for a distance of only 2.5
iles. Major tributaries include Little Piasa Creek, South Branch and Rocky Fork.

ne Wood River, which is formed by the junction of East and West Forks at a point
.2 miles above its confluence with the Mississippi River, drains an area of
pproximately 70 square miles in Madison County. Major tributary streams, East
ork and West Fork, originate in Macoupin County and flow through rolling agricul-
ural and forested upland areas to their junction in the flood plain.

ahokia Creek, with an upland drainage area of approximately 280 square miles (150
quare miles in Madison County), rises in Macoupin County and flows in a south-
esterly direction approximately 48 miles to the American Bottoms where its flow
s intercepted by the Cahokia Diversion Channel. This 4-mile canal flanked by
evees on both sides was constructed by the East Side Levee and Sanitary District
n 1915 to divert the flow of Cahokia and Indian Creeks west to the Mississippi
iver by gravity flow. Cahokia Creek's numerous tributaries include Indian Creek
the only continuous flow stream), Paddock Creek, Joulters Creek, Sherry Creek,
est Fork, Burroughs Creek, and Mooney Creek. Runoff from two of these streams--
oulters Creek and Mooney Creek--has been impounded to form Holiday Shores Lake
nd Dunlap Lake, respectively. Both artificial impoundments are in the vicinity of
dwardsville and represent the largest lakes in the PIWOCA planning area.

treamflow Data - Streamflow data is obtained from U.S. Geological Survey measure-
ng stations at three points in the PIWOCA planning area. The measuring station on

Indian Creek provides a continuous record of water stage and discharge for the last thirty-five years; the station on Cahokia Creek, which records the annual discharge and flood frequency, has provided nineteen years of record; and the station on the Mississippi River at Alton has provided a continuous record of water stage and discharge since 1904.

Ground Water

When surface water infiltrates into the ground, it becomes the part of the hydrologic cycle known as ground water. After this water has entered the ground from precipitation, streams, and lakes it moves downward until reaching an impervious substance. At this point, water accumulates to form a saturated zone. The upper level of this zone of saturation is known as the ground water table or simply the water table.

The level of the water table is not static, but is affected by many variables. The amount of water entering the ground water supply is affected by natural factors of precipitation, vegetation, and evapotranspiration. Man's activities in reservoir construction, paving over ground water, agricultural practices, and ground water pumpage all affect recharge and ground water table level.

In terms of water table fluctuations, the large supplies of ground water which occur in the unconsolidated sand and gravel aquifers of the American Bottoms are an important factor in planning for surface drainage and flood control in the American Bottoms portion of the PIWOCA planning area.

Prior to settlement of the American Bottoms, the water table was very near the surface and shallow lakes, ponds, swamps and poorly drained areas where widespread. Flood waters from the Mississippi River and various upland creeks frequently inundated large sections of the lowlands. Urbanization led to the construction of levees and drainage ditches, and the development of industry and large ground water withdrawal from wells. Each of these factors contributed to lowering the ground water level. By 1950, 40 percent of the former natural lake area had been eliminated and ground water levels in the immediate areas of heavy pumping were lowered from 10 to 50 feet, while adjacent areas were lowered from 2 to 20 feet depending on their proximity to the pumping areas and to the sources of recharge.

Since 1966, in most of the bottoms area, the trend has been reversed and the water table has been rising. The substantial reduction in industrial pumpage in some areas since 1964, and hydrometeorologic conditions favorable for ground water conditions have been important factors in this reversal. In addition, prolonged periods of high river stage during 1973 caused further increases in ground water levels by preventing normal ground water runoff to the river (1973 ground water hazard areas in the American Bottoms are shown on Plate F-1 and Appendix F of this report).

In the northern portion of the American Bottoms (the PIWOCA planning area), however, continued large ground water withdrawals for industrial use has minimized the problems associated with high ground water levels. During 1973, ground water azard areas in the PIWOCA portion of the Bottoms were confined to areas adjacent to he Mississippi River and the Cahokia Diversion Channel.

ydrometeorologic Conditions[4]

ne climate of the greater St. Louis area is characterized by four distinct seasons ithout the undue hardships of prolonged periods of extreme cold, extreme heat, or igh humidity. Both, warm moist air from the Gulf of Mexico and cold air masses rom Canada influence local weather conditions. Precipitation is usually adequate ven though summer drought periods are not uncommon. Because of its latitude, this rea experiences very abrupt temperature changes during all but the mid-summer eason.

emperature - The average annual temperature of 56 degrees Fahrenheit represents range in temperatures from January's mean temperature of 32 degrees to July's ean temperature of 79 degrees. The three winter months are generally cloudy, amp and chilly. Severe outbreaks of cold polar air move through the region every inter and produce minimum temperatures as low as a minus 10 to a minus 15 degrees. hese cold waves generally are of short duration and in three or four days more oderate, above-freezing weather returns to melt the snow quite often produced by rontal action along the leading edge of the cold air. The lowest temperature ecorded by the National Weather Service in St. Louis was minus 22 degrees in anuary of 1884.

uring July and August, maximum temperatures above 90 degrees occur approximately 2 days. When warm pressure centers stagnate over the region, temperatures can be xpected to exceed 100 degrees for short periods of three to five days, with the bsolute maximum of 115 degrees recorded in July, 1954. Generally, the summer onths record an average daily temperature range of only 18 to 30 degrees which uggests summer nights at times can be uncomfortable. The growing season is approximately 200 days from the 10th of April to the end of October.

recipitation - Normal annual precipitation for the St. Louis area, based on an 0-year average, is slightly over 35 inches; but if only the last 25 years are conidered, the average increases to 39.5 inches. June normally is the wettest month nd has an average of 4.3 inches of rain. Thunderstorms, which produce most of ne summer rain, are responsible for the unusually heavy rains which have resulted n isolated flooding. Long-time records show rather rare monthly precipitation aximums of 11 inches during the summer months and also a few daily maximums of 4 nches during the most severe thunderstorms. Rainstorms producing 1 to 2 inches f precipitation in a few hours are rather common. During the summer months, the id-day relative humidity ranges between 50 and 60 percent with early morning eadings near saturation. Winter humidity is 10 to 15 percent higher and when eritime tropical air from the Gulf moves in at temperatures just below freezing light frost will cover the vegetation. Snow can occur in any or all months from arly November through April. Average annual snowfall is approximately 17 inches. lthough most snowstorms produce less than 5 inches of snow, maximum depths of 10 to 12 inches do occur in the most severe storms. Winter ice storms are not a yearly occurrence but most records suggest that damaging ice storms that are severe enough to harm trees and power lines can be expected about three times in ten years.

Clouds - Clear to partly cloudy days occur more than 66 percent of the time. Summer months register clear days or clear with scattered cumulus clouds approximately 70 percent of the time. Winters are considered to be rather cloudy since about 40 percent of the days tend to be overcast. On the average, there are 102 clear days per year. The bottomlands experience 40 foggy days a year with almost all of these days occurring in the cooler six months of the year. Heavy fog is recorded on an average of ten days each year. A few radiation fogs develop during the fall season but, in general, most of the fog is of the advection type and is a result of the cooling of warm moist air masses from the south. When this maritime tropical air stays in the area for two or three days in the winter, dense fog will develop. This type of fog is capped by warmer air aloft which serves to trap all impurities in the lower 1,000 or 2,000 feet to produce a rather dense, and at times irritating smog. Smog conditions occur anytime there is warmer air aloft to restrict rising air currents. In late summer and early fall, warm dry maritime air from the Pacific may move into this region and trap cooler air at the surface which produces a smog condition that may last a week or longer.

Wind - Prevailing winds are southerly for all of the year except during the three winter months when northwesterly winds dominate. Since this area is in the path of many cyclonic storms, winds are experienced from every direction. As storms approach from the west, winds tend to be easterly and light in velocity until the front passes; winds then increase in speed and shift to a westerly direction. Wind speeds generally average between 10 and 15 miles per hour but in severe thunderstorms and during tornado conditions, wind velocities reach 50 to 75 miles per hour. Damaging hail is not uncommon during the most severe thunderstorms.

These same cyclonic storms that can produce thunderstorms, heavy rains, hail and high winds are also resonsible for beautiful clear, cool and energetic days that follow in their wake. These changes in weather are to be expected as the rule rather than the exception and can be looked forward to even during the very hot spells of July and August.

EXISTING MAJOR DRAINAGE AND FLOOD CONTROL FACILITIES

Major drainage within the PIWOCA Planning Basins is, for the most part, provided by a natural stream network--the major stream and its tributaries within each basin. In the American Bottoms portion of the PIWOCA planning area, however, the existing facilities include man-made channels and ditches, levees, gravity outlets and pumping stations in addition to natural streams and lakes.

The Wood River Drainage and Levee District which includes most of the Bottoms area within its boundaries, operates and maintains most major drainage structures and flood control facilities including 22 miles of front and flank levees which provide otection against flooding from the Mississippi and Wood Rivers; gravity structures d pumping stations; and a low water dam at the mouth of the Wood River.

the present time, stream and storm runoff which enter the Bottoms can be removed om certain areas by gravity flow, and from other areas by pumps and storm water wers. Gravity flow is obtained by ditches which generally follow low areas to tlets which then discharge through the levees. As a part of this operation, water ponded in Grassy, Smith, and Herman Lakes. In addition to the gravity system, ere are storm water sewers which serve the urban and industrial areas. There are rty gravity outlet structures in the district. Twelve of these are part of the mping station installations and can be used when Mississippi River stages are low d pumping is not required.

avity type outlets allow water to flow from the district when river stages are low d the outlet gates are open. Table 17 presents data on outlets within the Wood ver Drainage and Levee District 36 inches and larger, exclusive of pumping station avity outlets. Data for each outlet includes size, levee station, invert elevaon, size of tributary area, and gate-closing stage.

Table 17
OUTLETS FOR GRAVITY DRAINAGE
WOOD RIVER DRAINAGE AND LEVEE DISTRICT

esignation No.	Size (inches)	Levee Station	Invert Elevation	Tributary Area (acres)	Gate Closing*
2	2 - 60	124 + 27	398.58 LS 397.20 RS	2,770**	25
3	72	217 + 30	408.00 LS 407.50 RS	1,000	20
6	48	32 + 24	431.72 LS 427.88 RS	493	45
8	36	62 + 60	429.00 LS 426.40 RS	59	40
10	42	91 + 30	423.89 LS 422.48 RS	46	35
12	36	124 + 76	417.21 LS 415.17 RS	31	30
21	48	230 + 63	400.00 LS 397.25 RS	975	25
24	36	343 + 25	421.00 LS 413.10 RS	105	35
27	48	447 + 16	423.18 LS 416.67 RS	186	40
28	48	463 + 67	422.67 LS 417.65 RS	237	35
29	48	490 + 36	419.34 LS 417.22 RS	352	35
30	72	506 + 01	416.36 LS 413.56 RS	3,160	35
31	42	530 + 30	420.52 LS 418.63 RS	186	35
32	36	581 + 00	422.50 LS 419.90 RS	1	35

* Gate closing is referred to Market Street gage, St. Louis, on which 30 feet is bankful stage.

** Area is also tributary to Alton pump station during periods of blocked gravity flow.

Table 18
EXISTING PUMPING STATIONS
WOOD RIVER DRAINAGE AND LEVEE DISTRICT
(WRDLD)

Name	Levee Station Location	No. of Pumps	Capacity	Jurisdiction
1. Alton Station	50 + 64	2	23,000 gpm	Wood River Drainag and Levee Distric
1a. Alton Station	50 + 74	1	13,500 gpm	WRDLD
2. Homegarden Station	40 + 01	2	8,800 gpm	WRDLD
3. Lakeside Station	11 + 50	1	6,750 gpm	WRDLD
4. East Alton Station	97 + 15	2	28,000 gpm	WRDLD
5. Wood River Station	236 + 35	3	22,000 gpm	WRDLD
6. Rand Station	283 + 09	2	10,500 gpm	WRDLD
7. Hawthorne Station	309 + 08	2	27,000 gpm	WRDLD
8. Roll Bond Station	119 + 12	3	1,500 gpm	Olin Mathieson
9. Central Station	126 + 60	2 2 1	2,000 gpm 3,230 gpm 2,500 gpm	Olin Mathieson
10. West Slough Station	132 + 00	1 1	1,800 gpm 1,000 gpm	Olin Mathieson
11. Machine Gun Station	133 + 55	2 2	1,000 gpm 1,170 gpm	Olin Mathieson
12. East Slough Station	135 + 00	1	1,500 gpm	Olin Mathieson
13. Burning Ground Station	91 + 60	2	1,500 gpm	Olin Mathieson
14. Fusee Pump Station	108 + 50	1	1,100 gpm	Olin Mathieson
15. Powder Mill Station	119 + 31	1	2,000 gpm	Olin Mathieson

Source: Alva Sparks, Wood River Drainage and Levee District; and L.W. Maxon, Olin Mathieson.

PLATE

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WOOD

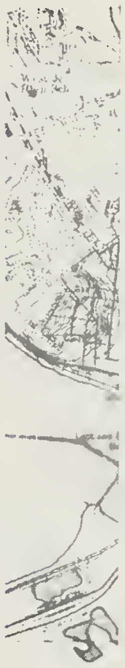

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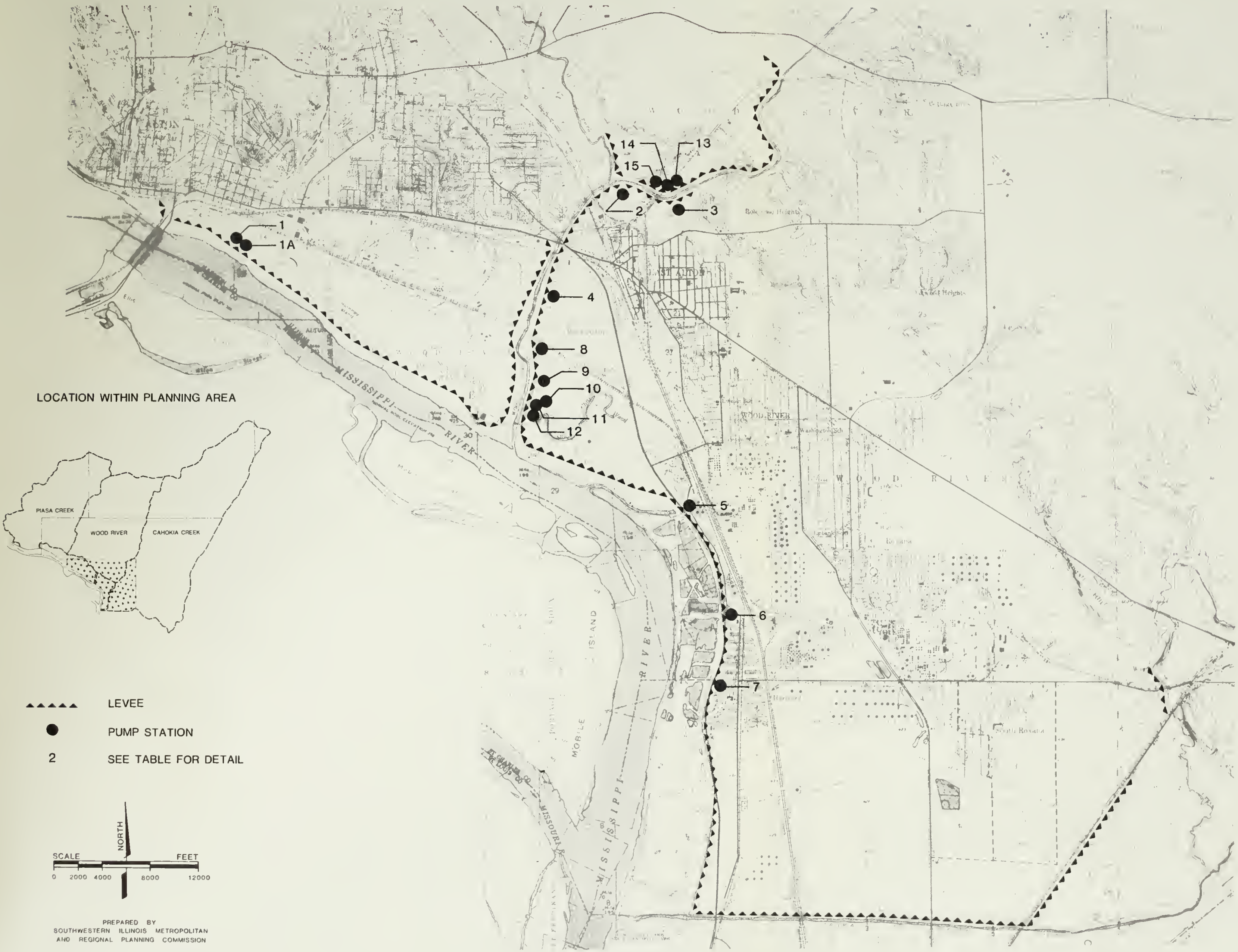
PLATE 13

MAJOR DRAINAGE AND FLOOD CONTROL FACILITIES

WOOD RIVER DRAINAGE AND LEVEE DISTRICT



LOCATION WITHIN PLANNING AREA

▲▲▲▲▲ LEVEE

● PUMP STATION

2 SEE TABLE FOR DETAIL

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THE PREPARATION OF THIS MAP WAS AIDED BY A STATE OF ILLINOIS PLANNING GRANT FROM THE DIVISION OF WATER RESOURCES A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

SOURCES: WOOD RIVER DRAINAGE AND LEVEE DISTRICT, MADISON COUNTY, ILLINOIS; AND OLIN CORPORATION, EAST ALTON, ILLINOIS.

tructures which empty into Wood River and its two forks remove water from areas
hich are primarily urban and agricultural, although there is some industrial usage.
hose which empty directly into the Mississippi River control areas used primarily
r urban and industrial purposes with a small portion devoted to agriculture.
tlet structures emptying into Cahokia Diversion Channel and Indian Creek control
eas which are primarily agricultural. The principal drainage courses of the area
e Wood River and the Cahokia Diversion Channel. Levees which border these water-
urses extend to high ground. East Alton ditch is the only ditch within the limits
the district large enough to be considered a principal ditch. This has its
rigin in an area north of the City of Wood River between the city limits and the
uff line. It flows in a northwesterly direction into the East Fork of Wood River
a Lakeside pump station during high Mississippi River Stages and through a gravity
tlet when low river stages permit such operation. There are also other numerous
all ditches traversing low areas which remove bottomland water and channelize
ll land runoff. Storm sewers also discharge through the levee by gravity drain-
e structures when river stages permit.

the present time, there are sixteen pumping stations in the Bottoms area (Plate
). Some storm runoff and all sanitary and industrial wastes are pumped into the
ssissippi River or the Wood River during periods of blocked gravity drainage.
ght pumping stations are under the operating jurisdiction of the Wood River
ainage and Levee District; Olin Mathieson Corporation operates the remaining
mping facilities. Information concerning the pumping stations is given in Table
; location of pumping stations is shown on Plate 13.

TORM DRAINAGE MANAGEMENT

an aspect of water resource management, the control of storm runoff and floods
an intergovernmental concern. There is considerable overlapping of responsibil-
y for storm drainage and flood control measures between agencies operating at all
vels of government--federal, state and local. Storm runoff management and flood
ntrol involve several activities: planning, financing, design, construction, reg-
ation, operation and maintenance. Governmental units and agencies with juris-
ictional authority in storm drainage management within the PIWOCA planning area
e discussed in the following paragraphs.

gencies Practicing Storm Drainage Management

licy decisions concerning storm drainage management and flood control within the
WOCA planning area are made principally by the agencies shown in Table 19. The
ble identifies five federal departments, three State of Illinois departments and
eir principal divisions, and three types of regional and local agencies. The
anning area is located within one county and contains nine municipalities and
ree special purpose agencies. These public agencies set limits and incentives
thin which many private firms and individuals deal with storm water runoff.

hich administrative units within this complex maze of governmental structure are
acticing storm drainage management and flood control at a scale that has

significance for the PIWOCA planning area? Very few have the legal and administrative authority necessary to do so, though drainage management measures now being practiced piecemeal by certain of the smaller administrative units could, if coordinated, have an impact on the planning area (Table 20).

Federal Agencies - Federal activities in storm water management and flood contro in the Planning Basins are confined largely to the programs and projects of the U.S. Army Corps of Engineers, the Soil Conservation Service, and the Department of Housing and Urban Development through the Flood Insurance and the Community Development Programs.

The Corps of Engineers is currently active in the Wood River Drainage and Levee District. In 1957, Congress authorized the Corps to investigate the engineering and economic feasibility of improvements for the control of interior flooding in the District. The plan recommended by the Corps in 1962 was approved in 1963, and authorized for construction in 1965. (See Chapter 2 of this report for plan description.) At the present time, the 1962 plan for the control of interior flooding is being reevaluated by the St. Louis Corps District. Other significant Corps activity in the area includes flood insurance studies (delineation of flood hazard areas) for the National Flood Insurance Administration.

Although the Soil Conservation Service is not presently involved in major flood control projects within the PIWOCA planning area, it is active in related programs. A detailed soils survey has recently been initated for Madison County. The Service provides research data and advice to the Soil and Water Conservation Districts and other agencies involved in storm drainage planning, and erosion and sediment control. The state and regional offices of the Soil Conservation Service have been especially helpful to SIMAPC in the Surface Drainage Program through the use of its computer programs, erosion and sedimentation research and general soils information

The Department of Housing and Urban Development, through the Flood Insurance Administration and the Community Development Program, is providing financial help and flood hazard area mapping to aid in flood plain management regulations. Several communities in the planning area are utilizing Community Development funds for local drainage projects. Local units of government eligible for flood insurance include Madison County and eight of the nine FIA-designated municipalities located within the planning area. These communities will be supplied with flood hazard area maps to aid them in the implementation of wise flood hazard area management.

Programs of the Departments of Commerce and the Interior are confined to research and data collection. The Water Resource Divisions of USGS measure and analyze stream flow data, and have published flood hazard maps for the planning area. The Weather Service (ESSA) measures and analyzes meteorologic phenomena such as precipitation and temperature which are necessary parameters in drainage planning and design.

State Agencies - The storm drainage management and flood control programs of the State of Illinois, presently administered by the Division of Water Resources, can

Table 19
GOVERNMENTAL UNITS AND AGENCIES WITH STORM DRAINAGE MANAGEMENT AND FLOOD CONTROL RESPONSIBILITIES

vernment Level	Department	Division	Number
deral	Agriculture	Soil Conservation Service	
	Commerce	National Weather Service	
	Defense	Corps of Engineers	
	HUD	Flood Insurance Administration	
		Community Development Program	
	Interior	U.S.G.S.	
ate	Agriculture	Soil and Water Conservation Districts	
	Education & Registration	Geological Survey	
		Water Survey	
	Transportation	Division of Water Resources	
gional		EWGCC	
		Bi-State	
		SIMAPC	
cal		Counties	1
		Municipalities	9
		Drainage Districts	3

Table 20
STORM DRAINAGE MANAGEMENT AND FLOOD CONTROL PRACTICES IN THE PIWOCA PLANNING AREA

	Type of Management Measure				
	Structural				Nonstructural Regulatory Measures
Agency	Major System	O&M*	Secondary System	O&M*	
ederal					
Army Corps of Engineers	X				
tate					
Division of Water Resources			X		
ocal					
Counties (1)			X	X	
Municipalities (9)			X	X	
Drainage and Levee Districts (3)	X	X			

*Operation & Maintenance

have influence throughout the planning area. Examples are its activities in loca drainage projects and regulation of development in flood hazard areas. The Division recently completed a study of the interior flooding problems in the Wood River-East Alton area. The project is currently in the detailed design stage (Appendix C).

Much of the basic data upon which effective storm drainage management programs depend are provided by research programs of the state scientific agencies, the Stat Water Survey and the State Geological Survey. The State Water Survey is responsible for perfecting methods in the use, development and conservation of water resources and studies relating to water quality and quantity (Appendix F). The Sta Geological Survey shares responsibility with the Water Survey on studies of groun water. In addition, it collects and analyzes geologic data applicable to water resources ("Geology" in Chapter 3 and Appendix G).

Regional Agencies - Three agencies, the East-West Gateway Coordinating Council (EWGCC), the Bi-State Development Agency, and the Southwestern Illinois Metropoli and Regional Planning Commission (SIMAPC), have been created and authorized by th State of Illinois to practice storm drainage management. The two former agencies EWGCC and Bi-State, are metropolitan in scope, dealing with the seven-county St. Louis metropolitan area. Neither of these agencies is currently involved in stor drainage management activities within the PIWOCA planning area.

The Southwestern Illinois Metropolitan and Regional Planning Commission was creat by the General Assembly in 1963 to promote the sound and oederly development of t Southwestern Illinois area. Under its mandate to devise general comprehensive pl to guide and coordinate the development of the water resource of the area, SIMAPC has carried out its water resource management planning programs which include the Surface Drainage Program.

Local Agencies - Counties have broad legal and administrative powers in storm drainage management. One of the more specific planning authorizations granted to counties is the power to zone in unincorporated territory and impose building regulations. Madison County is currently working with SIMAPC on new subdivision regulations which include specific storm drainage regulatory measures. In the absen of a public works department in the county, storm drainage management activities are under the supervision of the County Highway Commissioners (Plate 14).

Cities and villages have broad water management powers through their authority to regulate land use, buildings, and subdivision development. In addition, these local governments have powers to engage in drainage and flood control. These governmental units are also responsible for the provision of storm drainage syste within their areas (Plate 14).

There are three drainage and levee districts within the PIWOCA planning area (Pla 14). The Wood River Drainage and Levee District, the largest and most active district, is located within the American Bottoms portion of the planning area. As local sponsor for Corps projects, the district operates and maintains the levee

PLATE 14

ORGANIZA

PIASA CREEK,

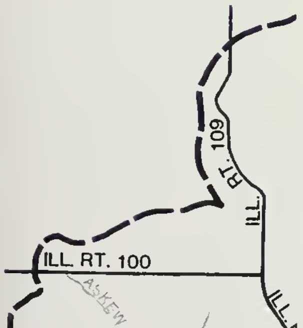

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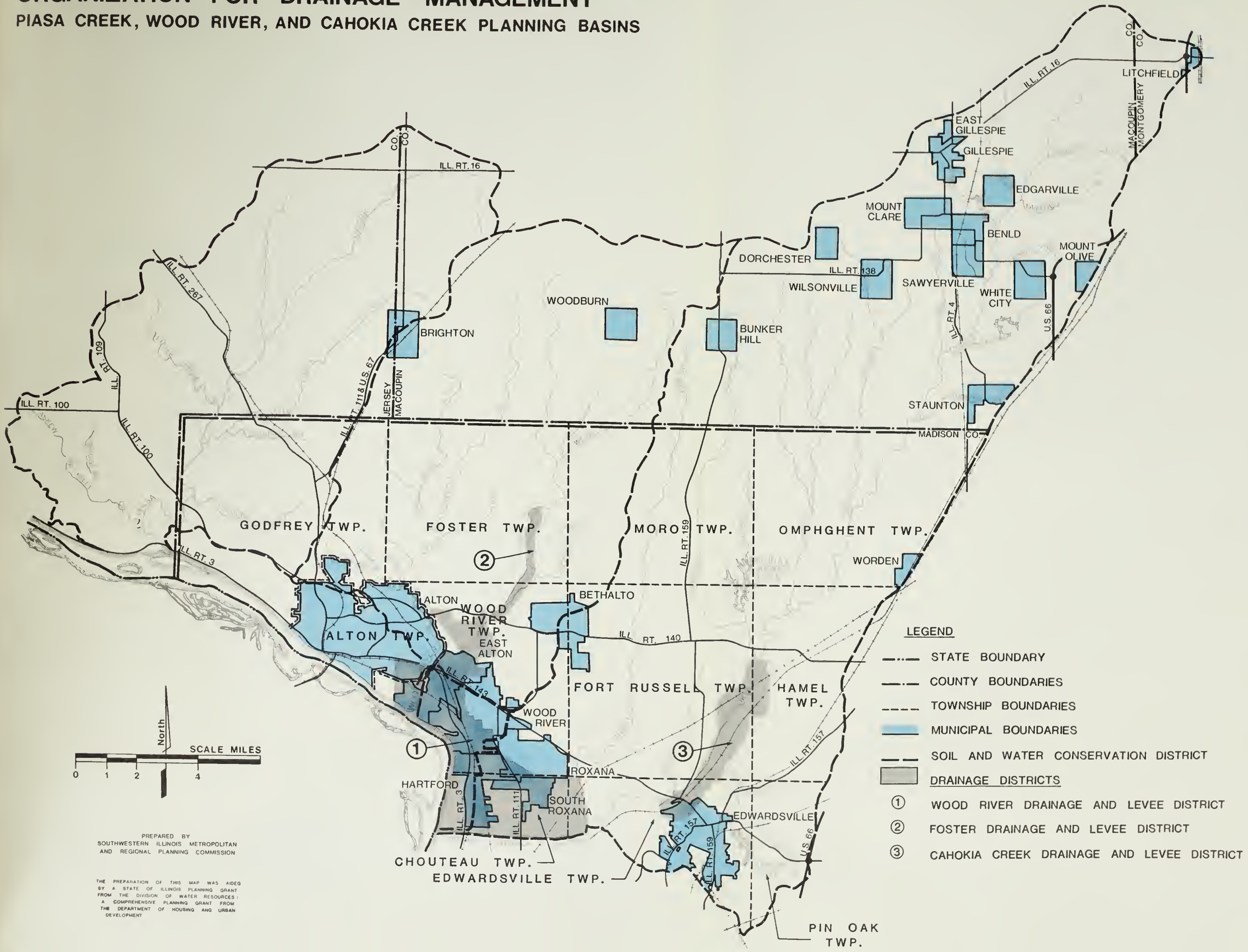
PLATE 14

ORGANIZATION FOR DRAINAGE MANAGEMENT

PIASA CREEK, WOOD RIVER, AND CAHOKIA CREEK PLANNING BASINS



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SOUTHWESTERN ILLINOIS METROPOLITAN
AND REGIONAL PLANNING COMMISSION

THE PREPARATION OF THIS MAP WAS AIDED BY A STATE OF ILLINOIS PLANNING GRANT FROM THE DIVISION OF WATER RESOURCES: A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

ystem which provides protection against riverine flooding from the Mississippi iver, Wood River, and the Cahokia Diversion Channel; gravity structures which llow storm runoff and sanitary and industrial sewers to discharge through the evees; and pumping stations for utilization during periods of high river stage hen gravity structures are blocked. The district is not involved in the construcion and/or operation of interior drainage facilities.

he Cahokia Creek Drainage and Levee District, located north of Edwardsville, emraces approximately 4,000 acres within the Cahokia Creek drainage basin. Active ince 1917, the district's current projects have been limited to maintaining and epairing their existing levee system.

he Foster Drainage and Levee District adjoins the Wood River District on the north. n 1921, approximately 975 acres along the East Fork of the Wood River were incororated to form this district for the purpose of straightening the channel for bout 3½ miles. The district is now inactive.

he above discussion indicates that no single administrative unit is operating a omprehensive drainage and flood control management program for the PIWOCA drainge basins collectively or individually. The limited management measures being aken often suffer from inadequate interagency or intergovernmental cooperation. review of the existing governmental structure of the PIWOCA planning area and otential governmental units under existing State Statutes which relate to the dministration of storm drainage and flood control can be found in Appendix D of his report.

* * * * *

Prepared by Paul DuMontelle and E. Donald McKay of the Illinois State Geological Survey, December, 1975.

Ronald E. Yarbrough, "The Physiography of Metro East," *Bulletin of the Illinois Geographical Society,* Vol. XVI, No. 1, June, 1974.

See James E. Thomerson, Special Report I: "An Inventory of the Fish Fauna of the St. Louis Standard Metropolitan Statistical Area," in Missouri Botanical Garden, *An Introduction to the Biological Systems of the St. Louis Area,* Volume II, for a discussion and listing of fish faunal groups.

Melvin Kazeck, "Section V, Climatological Elements," in *Environmental Inventory Report,* Part A, U.S. Army Corps of Engineers, St. Louis District, August, 1973.

BASIN ANALYSIS

4

SIN ANALYSIS

e problem definition phase of the surface drainage planning program involves sev- al analytical procedures. Analysis of existing basin conditions includes: (1) aluation of the physical and hydrologic environment of the three-basin PIWOCA udy area; and (2) evaluation of the existing major storm drainage facilities and nagement practices within the PIWOCA planning area. The data base necessary in is analytical approach to defining the causative factors involved in storm runoff oblems within the planning area is provided in the preceding chapter.

ditional approaches utilized in storm drainage problem definition in the planning ea include analysis of locally identified problems and perceived causes, and nctional analysis of the major drainage system including the hydrologic analysis storm runoff and the hydraulic evaluation of existing drainage facilities. ese analytical procedures, in terms of methodology and data results, are discussed this chapter.

OCAL PROBLEM DEFINITION

ring the basin planning process, an inventory of existing drainage facilities, ainage problems and perceived causes was completed through interviews with local ficials of all governmental units and special districts with storm drainage re- onsibilities in the planning area. Interviews with Madison County, nine munici- lities, eight townships and two special districts resulted in data concerning the pe and size of existing and programmed drainage facilities operated and maintained each jurisdictional entity; the location, extent, frequency and apparent cause storm drainage and flooding problems within each jurisdictional area; and the atus of drainage regulations adopted and enforced by the various governmental its. Interview responses were tabulated and mapped for each jurisdictional area, en aggregated and analyzed with respect to the major drainage systems in the anning area. These locally identified problems and perceived causes were given ll consideration in the development of alternative major drainage solutions.

cal Perception of Problems and Responsibility

terview responses, for the most part, indicated basic similarities in local per- ption of drainage conditions in the PIWOCA planning area. The way local offi- als perceived the physical environment, flood hazards, drainage problems and eir causes, drainage management and fiscal responsibility, differed only slightly th location and type of the jurisdictional entity interviewed. In general, most those interviewed in both upland and bottomland communities considered drainage oblems to be local rather than regional in nature; and that management responsi- lity, therefore, lay with each individual entity. Only the Cities of Wood River d East Alton and Wood River Township, all located (at least partially) in the uff Meander Belt of the American Bottoms, viewed their interior flooding problems regional or areawide in scope. (For description and further explanation of the uff Meander Belt see Chapter 3, page 33, in this report.)

Each of the governmental entities mentioned above felt that the severe interior flooding problems they experience are caused by excessive storm runoff from the upland areas and by the unwise practices of one another in the flood plain. Drainage conditions within their jurisdictional boundaries are, therefore, related and areawide in cause and call for regional responsibility in drainage and fiscal management. Interview responses further indicated that these lowland communities generally feel secure behind their "200-year" levees and tend to see little or no similarity between their physical environment and that of today's much-publicized hostile flood plain environment.

Drainage Facilities

Except for major drainage facility information supplied by the Wood River Drainage and Levee District and the Olin Corporation, data concerning the type, size and location of drainage facilities compiled by the inventory related to secondary or local drainage systems. For the most part, local storm drainage is collected in open ditches adjacent to municipal, township, and county roads within the PIWOCA planning area.

Secondary storm drainage systems play an important role in preventing urban damage due to storm water runoff and ponding. Throughout the inventory, the inadequacy o nonexistence of local drainage facilities were cited as the cause of many local drainage problems.

The Wood River Drainage and Levee District, which claims it has no authority to construct and manage drainage facilities for the prevention of interior flooding, cites the failure of the local communities to form a subdistrict for the purpose of providing drainage facilities and management and fiscal responsibility as the major cause of interior flooding in this area.

Problems and Perceived Causes

Collectively, local officials identified three major types of drainage problems within the PIWOCA planning area:

- retarded runoff due to inadequate drainage facilities;
- internal ponding; and
- overbank flooding.

More than thirty distinct problem areas, each exhibiting one or more of these problems, were identified during the interviews.

Retarded runoff due to inadequate drainage facilities was the most prevalent and widespread problem identified. Many communities reported internal drainage problems which cause street flooding and, in a few cases, residential flooding. This problem is intensified during periods of high river stages on the Mississippi Rive nd its major tributaries which block gravity drainage structures which normally rain the planning area.

nternal ponding is a problem, primarily in the flood plain of the Mississippi iver and its major tributaries within the PIWOCA area. This flooding, which is ost severe during the spring and fall months of each year, primarily affects gricultural lands.

verbank flooding was reported at various locations along natural and man-made rainage channels. Throughout the rural area, there are numerous places where reeks overflow onto adjacent farmland. This flooding is quite common but usually asts less than one-half day. Because of the short duration, it does not signifi- antly disrupt farm operations. Flooding of homes and outbuildings, however, is are in rural areas. In some locations, roads are flooded which result in making ome areas inaccessible by motor vehicle. Annual stream overflow is primarily due large accumulations of debris in the stream channel, the meandering stream ourse and inadequate stream capacity which often results from sedimentation.

rban communities adjacent to the major streams have not experienced significant verbank flooding in recent years. Nevertheless, community leaders are concerned bout potential damage. In the event of a "100-year" storm, significant damage ay take place in these urban areas. Portions of bottomland communities, unpro- ected by levees (Alton business district), are especially vulnerable to flood amage.

rainage Regulations

everal governmental units reported adoption and current enforcement of various or- inances dealing with land use controls, subdivision regulations and building codes. though storm runoff is considered in most ordinances, the regulatory measures rescribed are set forth in general rather than specific terms. No ordinances ere reported which specifically address drainage and flooding problems.

onclusions

e Drainage Inventory provided local perspective in defining storm drainage prob- ems within the PIWOCA planning area. Interview responses indicated few differ- nces in local perception of the nature and extent of the drainage problem and man- gement responsibility. These local responses are important to the development of an implementation strategies especially in terms of local or regional allocation responsibility in future drainage management.

rainage facilities data generated by the inventory deal primarily with secondary local drainage facilities. Repeated citing of nonexistence or inadequacies of ese local drainage facilities as a major causative factor in drainage problems dicates the importance of both major and secondary systems in solving total basin rainage problems.

Local officials identified several distinct storm drainage and flooding problems within the planning area. In terms of number of reported locations and area coverage, the most significant problems were internal ponding and overbank flooding. Hillside runoff and the lack of major drainage facilities in the Bottoms to retain and/or deliver this excess runoff to suitable outlets were reported as major causative factors in the internal ponding problems of the American Bottoms.

TECHNICAL PROBLEM DEFINITION

Functional analysis of the major drainage system within the PIWOCA watersheds was concerned with problem definition based on the hydrologic analysis of specific rainfall events with respect to the major drainage system, and the hydraulic evaluation of major drainage facilities in terms of their capability to convey storm runoff resulting from the 100-year rainfall event without damage to existing development. Two USDA Soil Conservation Service computer programs, referred to as TR-2 and WSP-2, were utilized in this technical analysis.

The TR-20 computer program computes runoff for given rainfall events based on a combination of parameters including watershed area, slope, land use, and hydrologi soil group. The basic function of the WSP-2 computer program is to compute water surface profiles for major system channels, given the TR-20 results. A detailed explanation of the TR-20 and WSP-2 computer programs is presented in Appendix A of this report.

Hydrologic Analysis

Rainfall frequencies used in runoff analysis were developed by the Illinois State Water Survey. These frequency values, published in Water Survey Technical Letter 13, are based on mathematical relations discussed in Water Survey Bulletin 46 by F.A. Huff and J.C. Neill and on data presented in U.S. Weather Bureau Technical Papers 24 and 25.

Table 21 provides point frequencies of one to ten days for the PIWOCA area. Value presented in the table were developed from station records of maximum yearly rainfall, and represent maximum-period rather than clock-hour or calendar-day amounts. Amounts apply to a point location, and within 5 percent limits, to areas up to 10 square miles.

Other parameters necessary to simulate modeling of the major drainage system, such as channel cross section measurement and bridge restrictions, were obtained throug field surveys; existing land use patterns, from stereo air photos; hydrologic soil data, from the Soil Conservation Service; and watershed area and slope from USGS topographic maps.

Hydrologic analysis of the existing drainage system in the PIWOCA planning area indicated that the flooding problems are basically those associated with overbanking, in the area above the bluff line. In the American Bottoms region, there are areas of internal ponding and inadequate drainage to the main streams. Severa

Table 21
AVERAGE RAINFALL FREQUENCY FOR STORM PERIODS OF 1 TO 10 DAYS

Average ecurrence Interval (years)	South Central Section Depth (inches) for Given Storm Periods (days)				
	1	2	3	5	10
2	2.7	3.0	3.3	3.8	4.5
5	3.7	4.0	4.4	5.2	6.3
10	4.5	4.9	5.5	6.3	7.7
25	5.8	6.3	7.0	8.0	9.8
50	7.0	7.5	8.4	9.5	11.7
100	8.4	9.1	10.0	11.5	13.9

ource: Illinois State Water Survey Technical Letter 13, December, 1970.

reas experience overbank flooding annually due to inadequate bridge opening or ulverts, while other areas experience annual problems of internal ponding due to nadequate secondary drainage facilities.

ydraulic Evaluation

valuation of existing drainage conditions in the major drainage areas within the lanning area was accomplished primarily through field work. Several field surveys ere made to assemble data and measurements for use in the simulation program. uring these investigations, actual watercourses and their points of discharge into xisting ditches or lakes were determined for small tributary drainage areas in the lanning area, and measurements were made of bridges and other obstructions in hese facilities so that accurate capacity computations could be made. At the same ime, existing facilities were being evaluated, major causative factors in flood azard areas were determined. As a result of these on-site investigations, the rainage inventory, runoff analysis, and other research projects, flooding and torm drainage problems in the planning area were defined and major causative factors determined.

n terms of the major drainage system, the most severe storm drainage and flooding roblems exist in the Bottoms. The natural drainage system in this area, which ncluded drainageways and a series of lakes for storm water detention, has been lmost totally destroyed; man-made facilities, such as major drainage channels and detention areas have not been constructed to replace the natural system. East Alto Ditch is the only channel within the Bottoms area large enough to be considered a major system facility. This ditch, which has its origin in an area north of Wood River between the city limits and the bluff, flows in a northwesterly direction int the East Fork of Wood River via Lakeside pump station during high river stages and through a gravity outlet when low river stages permit. The absence of outlets through the levees and an adequate system of channels to carry hillside runoff and interior bottomland runoff to the Mississippi River, the Cahokia Diversion Channel or Indian Creek has resulted in interior flooding in the southern portion of the Bottoms area.

Secondary or local storm drainage facilities, for the most part, are inadequate throughout the PIWOCA planning area. The inadequacy of these facilities causes muc of the flooding which occurs in the upland communities. In the Bottoms, inadequate local systems further aggravate the major drainage system problems noted above. In the flood plain, the importance of the adequacy of both systems, major and secondar, must be emphasized. An adequate major system alone cannot drain its tributary flat lands, while an adequate secondary system cannot function properly without an outle to an adequate major system. During an areawide storm, this problem is further aggravated in the Bottoms by the surge of hillside runoff, which is forced to sprea out over the flat terrain, often causing damages to adjacent urban structures and crops.

CAUSATIVE FACTORS

The drainage problems noted above which occur primarily in the American Bottoms portion of the PIWOCA planning area are brought about by various conditions which result from natural forces and/or from man's activities within the drainage areas. Factors which have a major impact on storm drainage within the PIWOCA planning are are discussed in the following paragraphs.

Natural Conditions

Natural conditions represent a major cause of storm drainage problems within the planning area. Unfavorable topographic and soil conditions have a major effect on the construction and operation of drainage facilities as well as on the natural rates of surface runoff. Many of the problems identified previously are largely the result of such unfavorable natural conditions as severe slopes and slowly perm- able soils.

Topography is one of the most significant natural conditions affecting storm runof Topographic conditions contribute to the problems of internal ponding, overbank flooding, erosion and sedimentation. As noted previously, internal ponding is a major problem in the American Bottoms due largely to a lack of relief. As a consequence, roadways may become impassable during heavy rainfall and many depressed are in the Bottoms become swampland. This ponding problem is further aggravated by storm water flowing from the adjacent steep sloped bluff area. This rugged topography causes an increase in the velocity of storm runoff from the upland area whic ontributes to overbank flooding and ponding in the Bottoms. The increased runoff ates also intensify the problem of upland erosion and sedimentation.

oil conditions also contribute to drainage problems within the planning area. oils along with slope are partially responsible for the problems of ponding, rosion and sedimentation. Bottomland soils occupying depressional areas are gen- rally slowly permeable thus intensifying ponding conditions. Other bottomland oils are generally less susceptible to ponding but are nevertheless poorly drained. ost of the upland soils have a severe erosion hazard due to slope and nature of oil materials. As a result, sedimentation problems exist in both upland and low- and areas as streams become filled with sediment which has eroded from higher ele- ations.

 addition to topography and soils, high ground water levels cause drainage prob- ems in portions of the planning area. The ground water problem is particularly evere in portions of the American Bottoms where the water table is at or near the round surface throughout much of the year. Where it is at the surface, swamps and akes exist. The presence of these ground water hazard areas, which are delineated n Plate F-1 in this report, should be noted as potential urban flood hazard areas n planning for development.

rainage Management

 the PIWOCA planning area, responsibility for drainage management is vested in a ltiplicity of agencies. This situation has often made it questionable as to ich agency is responsible for certain drainage facilities. The discrepancy rises basically as a result of two situations. First, areas may be located within re than one type of jurisdiction. For example, it is not always clear whether a calized drainage problem is the responsibility of the city, the township, the unty, or a special purpose district. Basic responsibilities, powers, and limita- ons of the various jurisdictional entities with drainage responsibility in the WOCA planning area are discussed in Appendix D of this report. Secondly, juris- ctional boundaries are not necessarily consistent with natural drainage bound- ries. Water does not respect political boundaries. Therefore, even after it has en determined which agency has responsibility for a specific problem area, a lution may not be possible because the causative factors are outside that agency's ea of jurisdiction.

 addition to the above situations, numerous problems have arisen due to a lack of ainage regulatory measures in subdivision regulations and building codes. No quirements have been established concerning on-site investigation of ground water, ils and geologic conditions. The absence of such regulatory measures has sulted in increasing problems for homeowners in some portions of the planning ea. A case in point is provided by Lincoln Addition in Wood River, which was veloped in the Bluff Meander Belt--the low-lying area between the bluffs and the od River Terrace. Runoff from almost any frequency rainfall event causes flood- g in this subdivision as well as in other developed areas within the Bluff Meander lt.

A major shortcoming in drainage management is created by the lack of regulations to provide control of runoff and erosion created by new construction. During construction, vegetation cover is removed and storm water runoff and erosion are greatly increased. Thus, severe drainage and sedimentation problems are imposed upon owners of adjoining land. After construction is completed, the addition of paving and roof tops tend to increase the velocity of storm runoff, creating a need for greater drainage capacity. Regulations specific to the planning area must be developed and enforced in order to alleviate these adverse conditions.

An overriding drainage management problem, particularly in the Bottoms area, is the absence of an agency responsible for constructing, operating and maintaining an adequate major drainage system. In most cases, the existing jurisdictional entities assume these management activities to be the responsibility of another. As a result, an adequate major drainage system has not been constructed and the natural drainage system has been destroyed. There exists, then, an immediate need to establish an acceptable allocation of drainage management responsibility throughout the PIWOCA planning area.

Related Project Coordination

In addition to the causative factors in storm drainage management and flood control previously noted, some adverse storm drainage conditions within the planning area have been caused or aggravated by the lack of coordination in planning, design and construction of other facilities, which affect the area's major drainage system. The lack of coordination pertaining to such activities and facilities has been apparent in a number of functional areas including transportation, conservation, and water resource management planning in areas other than storm drainage.

The lack of coordination between transportation and storm drainage activities has been exhibited primarily in planning and designing highway structures. Typically, coordination has been lacking in locating and sizing bridge structures, in erosion and sedimentation control during construction, and in consideration of existing drainage patterns and facilities.

Differences in the design storm frequencies used in transportation and storm drainage facility planning present a major problem. Highway structures are currently designed on the basis of the 50-year frequency event or less while major drainage facilities are designed to convey the 100-year frequency event. Consequently, highway bridges crossing major drainage channels can severely reduce the channel capability. On the other hand, highway structures which cross or discharge to small secondary drainage ditches (usually designed on the basis of the 10-year frequency event or less) can cause widespread local flooding.

During the construction of highway structures, and primarily during the excavation and grading of roadways, the lack of coordinating construction activities with soil and water conservation considerations has contributed to adverse drainage conditions. The erosion of disturbed and unprotected soils during construction has led to increased sedimentation of drainageways and subsequent reduction of drainage capacity.

There have been instances when other water resources management planning, design and construction activities such as those of water supply and distribution and wastewater collection and treatment have been pursued without taking storm runoff into consideration. The provision or extension of such services as water and sewer into areas inappropriate for urban development--from the standpoint of storm drainage--has further aggravated and reinforced the drainage problem. The provision of these services into areas inappropriate for urban development is symptomatic of the lack of adequate land use planning and control which is a more basic deficiency. Unless this basic deficiency is corrected, measures to replace inadequate storm drainage facilities or even other facilities such as highways and recreation areas may not reach their maximum potential in serving their intended purposes.

FLOOD DAMAGES

Flood damages, which affect both agricultural and urban land areas, occur annually in the American Bottoms portion of the PIWOCA planning area. These damages occur when excessive storm runoff enters the flatland area which does not have an adequate system for ponding and/or delivering the water to a suitable outlet.

The first step in developing annual flood damage dollar estimates is delineation of the flood hazard areas for a given flood. The extremely small amount of relief in the Bottoms, however, does not provide for easy determination of these flood hazard boundaries. The slight relief also makes it difficult to identify localized drainage patterns. Slight surface alterations resulting from agricultural activities, industrial and residential development, and construction of transportation facilities have, in some instances, drastically modified drainage patterns. As a result, the task of delineating flooded areas in the Bottoms becomes a highly specialized engineering endeavor requiring large amounts of manpower and detailed data.

The development of detailed flood damage estimates is beyond the scope of the surface drainage planning program. However, the following generalized analysis of flood damages is presented as an indicator of the severity of the flood damage situation.

The quality of storm water flow in the channels of the streams resulting from the 100-year frequency rainfall event (Q100), which was obtained from the runoff analysis, minus the capacity of the stream within its banks or levees equal the volume of storm water contributing to overbank flooding. Through the utilization of valley cross sections and the known volume of excess flow, flood elevation is determined and can be mapped. Given the Q100 this procedure indicates that the channelized and leveed segments of the major channels in the Bottoms area will not experience overbank flooding conditions. Rather, major damage and flooding problems within the Bottoms area can be attributed to excessive direct runoff from the bluff, and ponding within depressional areas. Thus, damages in the Bottoms are attributable to a lack of adequate secondary systems and not major systems.

In those areas upstream of the man-made levee systems, the existing major stream channels cannot contain the flow from the 100-year rainfall event. In these upland areas, the floodway resulting from the 100-year rainfall event ranges in width from a few hundred feet to over one-half mile. The vast majority of this flood area is on undeveloped land or agricultural land. Therefore, the extent of damages is dependent upon the types of agricultural use, the time of the year, and duration of flooding. However, in the Alton and East Alton area near the East and West Forks of the Wood River, there are four developed residential areas which are likely to be flooded with the event of the 100-year frequency rainfall. These total areas contain in excess of 200 structures.

Overall, damages resulting from overbank flooding include several thousand acres of agricultural land, and damages to over 200 commercial and residential structures In addition, damages due to ponding and hillside runoff are widespread throughout the Bottoms area and would be more precisely identified in evaluating secondary drainage systems in those areas. Other flood damages occur in the planning area in areas adjacent to the Mississippi River. However, riverine flooding by the Mississippi River is beyond the scope of this study and detailed damage analysis has not been completed.

PRINCIPLES FOR DRAINAGE MANAGEMENT

5

CONCEPTS FOR PLANNING STORM DRAINAGE MANAGEMENT

n developing a comprehensive plan for storm water drainage, the overall management
f the system must be considered in several different aspects. First, considera-
ion is given to available measures for management of the drainage itself. Second-
y, consideration is made for measures available to manage the associated problems
f erosion and sedimentation. The third and overriding consideration is that of
eans of organization to be established for overall effective management.

or any given area where storm water drainage and flood damages are existing or
otential problems, a set of various tools is available for correction and/or pre-
ention of these problems. The set can be divided into two functional categories,
ased on the measure's function to either correct an existing drainage problem or
o prevent or reduce future problems. Measures in the corrective category are
tructural, while preventive measures are regulatory. Sound storm drainage manage-
ent is achieved through utilization of a workable combination of the two types of
easures.

ORRECTIVE MEASURES

orrective or structural measures available for flooding and storm water drainage
nclude structural changes within, parallel to, or adjacent to the main channel of
he drainage system. Most frequently used measures are levees, floodwalls, res-
rvoirs, detention basins, channel improvements, diversion, pump facilities, and
and treatment. Each is distinctively different in its physical form and manner of
unction and warrants description.

evees and Floodwalls

evees and floodwalls are designed to protect a local area from the effects of
lood. They are built near the normal stream and should be located so as to pro-
ide maximum protection while encroaching as little as possible on the natural
loodway. Floodwalls can be constructed of concrete, steel sheet piling, or other
uitable structural materials. Regardless of type, the wall must have adequate
trength and stability to resist the applied loads. Floodwalls are subject to
lood loadings on one side only with no resisting force at the interior side and,
herefore, must be well founded. Levees are earth embankments. Space requirements,
uitable foundation soils, exposure to open water, adequate outlets for gravity or
ump drainage, access for construction and maintenance, and availability of suit-
ble fill material are the major criteria to evaluate when considering levee con-
truction.

he major advantage of levees and floodwalls is that they permit use of otherwise
nsuitable land by eliminating or reducing the amount of excess water escaping the
ain channel. Disadvantages include: (1) loss of flood storage capacity with
ossible flood loss increase elsewhere, (2) storm water behind the barrier may
reate problems, (3) overtopping or failure of the barrier can result in serious
lood damages, and (4) costs involved in constructing a barrier may be extremely
igh.

Reservoirs

The function of reservoirs is to store water when stream flow is excessive and to release it gradually after the threat of flooding has passed. This can be accomplished by building dams on a main stream or on tributaries.

Reservoirs, however, can be constructed to serve more than one useful function. I addition to providing flood control, a reservoir can be designed for recreation, fish and wildlife conservation, and/or as a water supply for local communities. Disadvantages of a reservoir include: (1) the reservoir will eventually become filled with sediment if appropriate measures are not incorporated, (2) ground wat levels adjacent to a reservoir will rise, and (3) a large amount of land is neede.

Detention Basins

The purpose of a detention basin is to retain or detain floodwater, thereby reduci the peak flow at a point immediately downstream of the impoundment. The most effective reduction in peak discharge per unit of storage from a drainage area is given by a detention basin. The detention basin can be utilized at two scales. C a small scale, the measure can be effectively used in an area of urban developmen to maintain flow from the area at a predevelopment level. On a larger scale, the measure can be used in conjunction with a stream to prevent downstream channel ca- acity from being exceeded.

Retention basins should only be located on a drainage channel if the channel only carries storm runoff. Their retention efficiency is not as great as detention basins per unit of storage. If, however, the aim of a basin is to reduce the fre quency of fairly small floods downstream and at the same time provide some storag for irrigation water, such a retention basin may be very useful.

Major advantages of a basin include: (1) collection of excessive stream flow and release at a slower rate which usually results in a flattening of the hydrograph, (2) possible limiting of flood drainage to upstream property, (3) possible reduction in the size of downstream storm drainage facilities, and (4) the basin may b designed to serve multi-purpose uses such as recreation or sediment control. Maj disadvantages are: (1) basins will not significantly reduce the damaging effect f the very serious floods in the main stem of the larger watersheds; (2) the increased duration of flow created by the detention basin may upset the natural equilibrium of the channel; (3) unless carefully managed, basins can become an eyeso; (4) basins may become a mosquito breeding area; (5) considerable amount of land i needed; and (6) very high expenses will be incurred if the basin cannot be emptie by gravity flow and must be emptied by pumps.

Channel Improvement

Channel improvement is used as a single purpose method of flood prevention to supplement levee systems. Channel improvements help provide enlargement of the discharge capacity of natural channels by means of straightening, cutoffs, clearing nd snagging of debris and vegetation in the channel, and widening and deepening he channel.

he major advantage of channel improvement is an increase in the capacity and abilty of the channel to carry the flow from the particular system being improved; lus, it may also be designed to carry the flow from its entire drainage area. Disdvantages associated with channel improvement are: (1) an increase in peak disharge downstream from the end of the improvement may cause significant damages; 2) unless appropriate measures are taken, the channel may have excessive scour nd/or sediment deposition; and (3) channel improvement projects can be very expenive.

iversions

iversions are channels designed to divert water from an area where it is in exess to sites where it can be used or disposed of in a manner superior to the riginal course. The outlet may be a grassed waterway, vegetated area, grade stailization structure, or direct connection to a stable channel.

dvantages of a diversion channel are: (1) a reduction in downstream floodwater eaks, (2) water may be diverted to areas where additional water is needed, and (3) t may be possible to reduce the size of storm drainage facilities. Disadvantages f a diversion channel include: (1) a large amount of land must be acquired, (2) onstant maintenance may be required to remove sediment depositions, and (3) if not roperly designed, there is the possibility of erosion or scour.

and Treatment

and treatment is an effective means of controlling runoff in small watersheds. It nvolves vegetation and mechanical measures to delay runoff from the land and retain ater in the soil. Mechanical measures which can be used include: seepage beds and itches; porous pavement, runoff spreaders, and cisterns. Mechanical measures can e very effective and, where water is stored, may be used for other purposes. hese measures, however, are usually expensive and require constant maintenance.

egetative techniques for controlling runoff include: mulching and seeding on base oil, terraces for steep slopes, and minimum cultivation techniques. In addition o decreasing runoff, vegetative measures can effectively control erosion and sedient yield. Many of these measures, however, are inadequate by themselves and must e used in conjunction with other techniques.

REVENTIVE MEASURES

lood plain regulations imply the adoption and use of legal tools by municipalities, ounties, special districts, or states to control the extent and type of use peritted in flood plains to prevent damage. In order to be effective, it is necesary to make the public aware of the flood risk and the overall benefit to the community which would result from proper use of the flood plain. Different types of regulatory controls include zoning ordinances, subdivision regulations, building codes, health regulations and warning signs. These may be used separately or in combination.

Zoning Ordinances

Zoning ordinances are legal tools used by municipalities, townships and counties to regulate and control land development within their respective jurisdictions. These ordinances can greatly reduce flood damages by zoning floodways to be reserved for passing floodwaters and for open land uses which suffer little damage. The areas adjacent to the floodway should be zoned for uses which will not be affected by high water.

Regulations pertaining to flooding can be used in conjunction with zoning in three ways. First, the procedural, administrative, and use provisions contained in flood hazard regulations can be modified for inclusion in a new comprehensive zoning ordinance. Secondly, a flood regulation ordinance can be utilized as an "overlay" through an amendment to an existing zoning ordinance. Thirdly, the flood regulation ordinance can be adopted separately for a locality which does not have a comprehensive zoning ordinance but does have a flood problem.

A well-designed flood plain zoning ordinance will minimize unnecessary and unwanted property damage while at the same time assuring the best possible use of the land. Some private interests may be restricted from initiating future development plans if they are not in compliance with the flood plain zoning ordinance. This would be viewed by many as a major disadvantage of flood plain zoning. However, the overall quality of development can be enhanced if it is kept out of areas with a flood hazard.

Subdivision Regulations

Subdivision regulations can be a most effective tool for controlling growth and development in flood prone areas for the purpose of preventing future damage. These regulations may restrict or regulate the selection of building sites, size and extent of internal drainage systems, and size of lots. The subdivision of land which is in a flood hazard area can be prevented. Numerous other requirements which can reduce damages resulting from high water can also be incorporated.

The subdivision ordinance can be used in two ways. Localities which do not have a comprehensive subdivision ordinance but do have serious flood problems can adopt a separate flood hazard subdivision control ordinance. Secondly, items which deal directly with objectives, use restrictions, and special procedures unique to flood hazard requirements, can be inserted into an existing comprehensive subdivision control ordinance.

Advantages of a well-designed subdivision regulation include: (1) innocent purchasers are far less likely to be damaged by erosion or floods; (2) an assurance

hat subdivided land is suitable for its intended use; and (3) that the locality
ill not be forced to bear extraordinary costs for protection of flood hazard areas,
rosion control and the extension and maintenance of facilities such as roads, sewer
nd water into such areas.

uilding Codes

uilding codes are a set of regulations adopted by a local governing body which set
orth standards for the construction of buildings and other structures. These
odes, if properly enforced, can limit future damages to new buildings in the flood
lain. Floodproofing standards applied through the building code can permit de-
elopment in the lower risk flooding areas by keeping flood damage and other ad-
erse effects within acceptable limits. Floodproofing requires adjustments both to
tructures and building contents and involves keeping water out as well as minimiz-
ng the effects of water entry. Some of the types of floodproofing standards which
ould be adopted include:

(1) Proper anchorage to prevent flotations of buildings from their foundations.

(2) Restrict the use of building materials which deteriorate rapidly when exposed to water.

(3) Prohibit the use of equipment, such as chemical equipment storage, boilers, or electrical equipment, which may be hazardous to life if submerged.

(4) Establish elevation for basement and first floors based on normal floodwater heights.

(5) Require buildings to have a structural strength to withstand water pressure or a high velocity of flowing water.

n addition to reducing property damage, a main advantage of floodproofing habitable
tructures is to provide for an early return to normalcy after floods have receded.
major disadvantage of floodproofing is the false sense of security it creates for
ome occupants. These individuals may decide to remain during a flood, and thereby
isk being stranded or losing their lives. To insure continued effectiveness,
loodproofing measures must be maintained in perpetuity. With changes in property
wnership, this is very difficult to guarantee. Floodproofing may also increase
neconomical use of flood plains. Applied to structurally unsound buildings, flood-
roofing can result in more damage than would occur without floodproofing.

arning Signs

arning signs can be erected in areas subject to flooding indicating the extent of
looding in any one area. These signs impose no legal restrictions, but are in-
ended to inform and warn potential users of the risk of flooding and to discourage

development in flood plain areas. Such a sign would also provide a convenient reference and keep residents aware of the flood possibilities.

Health Regulations

Health regulations can be imposed for the protection of the general public where potential health hazards exist. In areas subject to flooding, garbage dumps, storage of chemicals or combustibles, septic tanks or other facilities which could result in a health hazard if inundated can be eliminated.

National Flood Insurance Program

The National Flood Insurance Act of 1968 was enacted to provide previously unavailable flood insurance protection to property owners in flood-prone areas. The program operates through an insurance industry pool under the auspices of the National Flood Insurance Association by means of a federal subsidy to make up the difference between actuarial rates and the rates charged to consumers for the protection provided.

In order to qualify for the sale of flood insurance, a community must adopt and enforce adequate land use and control measures consistent with federal criteria. Such measures must be designed to reduce or avoid future flood or mudslide damage and include effective enforcement provisions.

Flood insurance, if established on a sound equitable basis, can provide still another supplement to many programs for reducing flood damage. However, insurance rates should realistically reflect the flood risk in order to avoid encouragement of improper development of flood plains.

MEANS TO EROSION AND SEDIMENTATION CONTROL

The problem of erosion, and its counterpart sedimentation, is manifested as a destruction over time of drainage efficiency, if intensive maintenance is not applied However, there are numerous measures available for the control of erosion and the management of sedimentation problems. An extensive investigation of this subject was conducted in conjunction with the Surface Drainage Program. A summary of this investigation is presented in Appendix H.

ORGANIZATION FOR EFFECTIVE STORM DRAINAGE MANAGEMENT

An important concern of this study has been whether an effective program of storm drainage management could be carried out in the PIWOCA planning area withoug radic changes in legislation, governmental structures, and authority. Examination of th various agencies needed for funding and financing of planning, design, constructio and operation and maintenance of storm drainage facilities and flood control measures, as documented in Appendix D of this report, reveals an array of departments, ivisions, commissions, boards, and districts at all levels of government. These gencies range from general-purpose local units of government, such as counties, ities and villages; to special-purpose districts, such as drainage and levee dis- ricts and sanitary districts; to state regulatory bodies, such as the Illinois ivision of Water Resources; and to federal agencies that provide financial and echnical assistance for implementation of storm drainage management projects and rograms, such as the U.S. Army Corps of Engineers, the Soil Conservation Service nd the Department of Housing and Urban Development.

ecause of the multiplicity of existing agencies within the planning area, it be- ame exceedingly important to identify those agencies having the legal authority nd financial capability to implement the various elements of an effective storm rainage management program. Accordingly, only those agencies whose actions can ave significant effect, either directly or indirectly, upon the successful imple- entation of storm drainage plans and flood control measures and whose full coop- ration can be essential to an effective drainage management program were seriously onsidered in the study. These and other agencies that in special circumstances ight contribute to one or more functions of an effective storm drainage program re identified in Appendix D of this report.

nvestigation of the governmental structure of the planning area as it relates to ne administration of storm drainage management and flood control further indicates nat no single administrative unit is currently conducting a comprehensive storm rainage management program on a drainage basin scale, or is capable of doing so nder existing legislative and administrative conditions. The absence of a formal nstrument for coordinating the storm drainage and flood control activities now eing undertaken on an agency-by-agency and project-by-project basis at all levels f government is one of the greatest deterrents to an effective storm drainage anagement program in the planning area. This deficiency does not necessarily nply the need for a single storm drainage agency, but rather the need to establish reas of cooperation and coordination through which storm drainage management can e accomplished.

xpansion and coordination of the storm drainage and flood control programs of ex- sting agencies may prove to be the most feasible method of organizing for storm rainage management in the planning area. Though these existing programs are not ow solving the major storm drainage problems, it seems possible that a cooperative pproach which makes full use of existing legal powers and administrative organiza- ions might do so. Such coordination is difficult to accomplish, however, as evi- enced by the failure of existing programs to achieve many of the benefits that ould be derived from coordinated management of the storm drainage and flooding roblems of the PIWOCA planning area.

ne approach that has been tried in other areas is to strengthen counties by grant- ng them authority to perform new functions and to expand their operation in exist- ng functional areas. This has been done by consolidating a city and a county into single local government, by establishing new county institutions, and by strength- ning county governments through the transfer of certain functions from cities to ne county.

Another possibility would be the creation of county-wide drainage districts. County organization along these lines could serve as the foundation for multicount or regional and statewide programs and could help to implement regional and state water resource policies.

PRINCIPLES FOR PLANNING STORM AND FLOOD WATER MANAGEMENT

The foregoing assessment of storm runoff and flooding problems and causative factors in the Piasa Creek, Wood River, and Cahokia Creek planning area, and the cataloging of generally applicable relief measures have led to the formulation of ten basic planning principles. These principles were developed to guide the formation and the process of selection of plan alternatives.

1. A BASIN DRAINAGE PLAN IS THE BASIS FOR EFFECTIVE STORM DRAINAGE MANAGEMENT AND FLOOD DAMAGE PREVENTION IN A DRAINAGE BASIN.

The basin drainage plan coordinates storm drainage and flood control activities within a drainage basin by developing a plan and an implementation program for the major drainage system and by providing a set of criteria or guidelines to be used by local governments in planning, design and construction of the secondary drainag systems. Both structural and nonstructural (regulatory) measures are included in a basin drainage plan; and design and operating standards, as well as model ordinances, are developed as aids in plan implementation.

2. PROPER MAINTENANCE OF STORM DRAINAGE FACILITIES IS ESSENTIAL IN STORM DRAINAGE MANAGEMENT AND FLOOD CONTROL.

Sediment and debris which collect in drainage channels can severely decrease channel capacity and actually block channel flow at bridges and culverts. The physical characteristics of the PIWOCA Planning Basins, such as the contrasting topographic areas and the erosive character of soils and geologic deposits, are conducive to sediment and debris transport and deposition in the flat lands of the Bottoms area. To insure adequate drainage and flood control in these Basins, these problems and others call for a continuous program of maintenance, replacement and repair activities.

3. FLOODING AND DRAINAGE PROBLEMS ARE BEST AND MOST ECONOMICALLY SOLVED BEFORE AN AREA IS DEVELOPED.

Any number of measures are available to alleviate and prevent drainage and flooding problems when most of an area is still in open space use. Development of flood-prone areas can be prohibited through zoning or land acquisition. A variety of structural measures can be implemented to reduce the flood plain area including reservoirs, levees, and channel works. Structures can be floodproofed as they are built. Once an area is developed, zoning is nearly impossible, acquisition is prohibitively expensive, lands needed for structural control measures are occupied by

xpensive development, and floodproofing of structures is impossible or very expen-
ive.

MOST FLOODING AND DRAINAGE PROBLEMS ARE THE RESULT OF OCCUPATION OF FLOOD HAZARD AREAS. THEREFORE, UNLESS DEVELOPMENT OF FLOOD-PRONE AREAS CAN BE STRICTLY REGULATED, IT SHOULD BE AVOIDED.

addition to the overbank flood hazard, it is often difficult to provide an ef-
cient storm drainage system in areas where the lands are generally flat and where
e level of the receiving stream may, at times, be higher than the land which is
be drained. Since storm sewers cannot function with free outfall conditions,
ey become surcharged, back up, and cause storm water ponding and flooding in low
eas. Although the use of pumps in these situations can alleviate flooding con-
tions, the high costs associated with pump operation and maintenance and the prob-
ilities of mechanical or power source failure should be considered. To insure
otection from flood damage, structures built in these areas should be floodproofed.

DRAINAGE AND FLOOD CONTROL ARE MOST EASILY DEVELOPED AND MAINTAINED THROUGH BALANCED DEVELOPMENT OF OPEN SPACE AND URBAN LAND USE.

servation of open space corridors along drainageways through urban areas provides
ace for storm water conveyance and storage and for potential increase in the cap-
ity of conveyance facilities. Reservation of blocks of open space provides land
r potential construction of reservoirs and detention storage facilities.

nds reserved in flood plain areas and at potential reservoir sites generally are
e best lands for recreation and conservation uses and help to provide esthetic
rm and shape to urban development.

FLOOD CONTROL AND DRAINAGE SYSTEMS MUST HAVE A BALANCE BETWEEN CONVEYANCE AND STORAGE.

e construction and maintenance of extensive drainage channels and long, large
wers can be very costly. These costs may be greatly reduced by the introduction
detention storage in portions of a drainage area. Detention storage can be
st-effective where storage facilities for runoff can reduce major channel size
d levee works required for flood damage prevention and adequate drainage.
idge and culvert sizes and required pumping capacity can also be reduced in the
annel downstream from the detention areas.

TIMING IS CRITICAL TO ACQUISITION AND ZONING OF LANDS FOR DETENTION STORAGE AND FOR OPEN SPACE RESERVATION.

areas where urban development is projected but not yet in progress, acquisition
unoccupied land costs little compared to land costs in areas under development,
to land and improved property costs in developed areas. Land designated as

detention storage areas in drainage plans should be preserved immediately to insur its availability at the time of plan implementation. Without this preservation, development can quickly occur in such areas jeopardizing an entire drainage plan.

8. THE CONSTRUCTION OF UNDERGROUND FACILITIES SHOULD BE AVOIDED IN FLAT LAND AREAS WHERE STORM DRAINAGE IS DEPENDENT ON GRAVITY FLOW AND WHERE POTENTIAL HIGH GROUND WATER LEVELS EXIST.

Facilities such as basements and deeply incised road underpasses should not be constructed in flat land areas where storm water removal is dependent upon gravity drainage or in areas of potential high ground water levels. Even if pump facilities are provided for surface drainage and/or lowering of ground water levels, they often are not functional when required due to power failures. This principle also applies in upland areas where land slopes are good and the chances for failure and flooding are not nearly so great as on the flat lowland areas. Although the key word in this principle is "avoided," regulations adopted for specific localities where lands are very flat should "prohibit" below-grade construction o basements and underpasses.

9. FOR PLANNING AND DEVELOPMENT PURPOSES IT SHOULD BE RECOGNIZED THAT LAND COSTS INCLUDE STORM WATER CONTROL COSTS.

This principle is best illustrated by an example. If two parcels of land, one an upland area with good moderate land slope and the second on a broad flat flood plain are located the same distance from a large central city, the true cost of the two parcels of land differ even though their sale price may be the same. The upland parcel requires installation of only modest drainage facilities tying to the major drainage system. The low lying land parcel requires substantial expend tures for flood damage prevention and extra expenditures for drainage facilities and other utilities.

10. PROPER STORM WATER REGULATION CAN STIMULATE AREA GROWTH THROUGH PUBLIC CONFIDENCE.

Through a continuing information program, municipalities and other units of local government can keep the public informed of the relative flood hazard in areas under their jurisdiction. Commerce and residents can, with such information readily available, locate with confidence knowing that their wealth, health, and safety are free from the danger of floods.

Application of Principles — Although an attempt has been made during the planning process to adhere closely to the above guidelines, the absolute character of the principles has been relaxed to some extent in recognition of local desires. For example, increasing urban pressure is being exerted by development interests in portions of the planning area which is currently considered a drainage hazard (flood prone) area. Strict adherence to principle number 4, "Development of flo rone areas should be avoided" would preclude development in these flood prone reas. However, certain local units of government have demonstrated that it is eir desire, in full recognition of the inherent flood and drainage hazards and xtra costs of development, to permit urban development of these areas.

BASIN PLAN
FOR
MAJOR DRAINAGE

part three

CHAPTER 6
STRUCTURE AND NATURE
OF THE PLANS

CHAPTER 7
SELECTED PLANS

CHAPTER 8
IMPLEMENTATION STRATEGY

STRUCTURE AND NATURE OF THE PLANS

6

TRUCTURE AND NATURE OF THE PLANS

he activities involved in the development of plans for major drainage in the Piasa reek, Wood River and Cahokia Creek planning area are discussed in this section. ocumentation of the planning process in this final phase is presented in three arts: (1) identification and evaluation of alternative solutions and their com- onents which adequately address the previously defined problems and deficiencies n the major drainage systems of the three Planning Basins; (2) plan selection; and 3) suggested implementation strategies.

ubdrainage areas within each of the three basins have been delineated and discussed reviously in this report. Major drainage plans presented herein are for the adison County portion of three basins: (1) Piasa Creek, (2) Wood River, and (3) ahokia Creek. The State of Illinois, Division of Water Resources has developed rainage plans for a portion of the planning area in the vicinity of Wood River and ast Alton. The State plan, which is described in Appendix C of this report, is ccepted as part of the drainage plans for the PIWOCA area.

n developing major drainage plans for the PIWOCA basins, the approach varied with he nature of the basins. In the Piasa Creek Basin, the areas affected by flooding re rural and so small that extensive structural control is not warranted. There- ore, plan development for the Piasa utilized a non-structural approach. The Wood iver Basin, on the other hand, contains relatively large urbanized areas, parts of hich are located in potential flood problem areas. Therefore, this basin was pproached with a combination of structural and non-structural components. The pproach to Cahokia Creek Basin plan development was similar to that of the Wood iver Basin.

n the following discussion, components of basin plans referred to as structural re those which require an actual reshaping of the land surface or installation of echanical devices. Levee construction, excavation, channel construction, and redging are the usual reshaping components; the most common mechanical devices re pump facilities, culverts, flap-gates, spillways and bridges.

n addition to or in lieu of structural components, non-structural components are ssential in developing plans for major drainage in the planning area. The term on-structural refers to those components of the plan which are regulatory with espect to land use and construction specifications. These measures in conjunction ith structural measures help afford much greater protection, in that, they can egulate the quantity and quality of development in areas where structural measures including secondary systems) cannot be constructed with functional efficiency or conomic feasibility.

ach of the Planning Basins in the PIWOCA planning area has a separate set of prob- ems and therefore a separate set of alternative solutions. Combinations of struc- tural and non-structural measures have been formulated and considered for each roblem area. Physical characteristics and degree of developmental pressure in he problem areas helped to determine the most practical combinations.

Components of the plans for each basin were analyzed and generalized cost estimates were prepared for structural components. Unit cost curves for culvert installation reservoir excavation, channel dredging, bridge construction, and pumping stations were used to develop total cost estimates for comparison of alternative solutions. The costs are not intended to be interpreted as the results of a detailed cost analysis.

POTENTIAL COMPONENTS - PIASA CREEK PLANNING BASIN

After completion of the hydrologic and hydraulic analysis of the Piasa drainage area, the flood area related to the 100-year rainfall event was found to include no urbanized areas (see Plate 17 in Chapter 7 of this report). In view of the results it was considered economically impractical to utilize structural measures. This determination is further justified in that most flooded land is utilized for activities which are not totally damaged by the relatively short duration flooding.

Hence, the possible components considered for addressing the flooding problems within Piasa Creek Basin are primarily non-structural or regulatory. With the flood area identified, properly designed and enforced regulations can keep flood losses at a minimum.

The two basic types of non-structural measures considered appropriate for the problem area are land use regulation (zoning) and construction regulations in designate flood-prone areas. Detailed ordinances of the type which would be applicable are presented in Appendix E of this report. Utilization of these or similar regulation would prevent future potential losses due to flood damage in the Piasa Creek floodable areas within Madison County.

Environmental Assessment of Non-Structural Elements

The zoning and development restrictions within the 100-year flood plain of Piasa Creek should result in the protection of most of the forest and agricultural land on the flood plain. This flood-prone area includes much of the best area for archeological site location and much of the most valuable wildlife habitat within the Piasa Basin. The major concentrations of prehistoric Indian settlement in the upland areas occur close to streams. Although Piasa Creek and its tributaries have only been lightly surveyed, initial evidence indicates that a considerable number of archeological sites are located in the area. Most of the streams are lined with deciduous hardwood forest that provide good habitat for a variety of mammals, birds, reptiles and amphibians. The interface between stream and forest and agricultural fields are especially valuable zones for animals.

The limitations on development, improved soil conservation techniques, more effective control of septic tank stream pollution and the application of modern fish management methods should improve the use of the streams in the Piasa Basin for recreational fishing. Today, fishing is primarily confined to the lower portions of Piasa Creek and bullheads are the major species caught. Fishing would also be aided by the provision of more public access points along the streams.

unting is an important recreational activity on the 100-year floodway of the area's treams. Small game dominates the hunting with squirrels, rabbits and doves being ost important. Deer are the only big game hunted in the basin and provide sport or an increasing number of hunters.

n conclusion, the restrictions on development on the 100-year flood plain of Piasa reek should be of positive ecological and recreational value for the area's inabitants.

POTENTIAL COMPONENTS - WOOD RIVER PLANNING BASIN

Upon completion of the hydrologic and hydraulic analysis of the Wood River Basin, floodable areas resulting from the 100-year rainfall event were examined for possible solutions. Four areas containing structural development were identified within the floodable area, in which structural measures could possibly reduce flood damage. The four developed areas are identified on Plate 15 as WA, WB, WC and WD. Variation in the nature of each area affect the economic feasibility and functional effectiveness which may make protection for one or more areas more practicable than for others. The following descriptions of each of the structural components for reduction of potential flood damages, take these variations into consideration. The identifying letter of each component corresponds to Plates 15 and 16. Various combinations of these components are presented in Appendix B of this report.

WA - Eastern Alton Levee

The existing levee on the west bank of the Wood River terminates at Illinois Route 143, 1000 feet west of the stream. The area adjacent to the Wood River immediately north of this levee has a potential flood area of 75.4 acres. Located within this area are 58 structures, 52 of which are residential and 6, commercial. The most recent development in this area includes approximately 35 residential structures along the extension of Aberdeen Street.

In order to provide protection from flood damage for the structures in this area, structural measures would be required. Based on the results of the TR-20 and WSP-2 computer program analysis of the 100-year rainfall event in the Wood River Basin, it was determined that the flood elevation at this location would be 441.1 feet above mean sea level. In order to provide protection from this flood elevation, a levee would be required with a length of 3,750 feet and an average height of 12 feet. The levee would be constructed with an 8-foot wide crown and a 56-foot wide base, giving a levee side slope of 1:3.

The suggested levee would prevent overbank flooding in the developed area. However, additional structural features are required in order to prevent interior flooding. Hillside runoff from the area protected and from adjacent land on the bluff must reach the Wood River through the levee. To provide this conveyance of storm runoff to the main channel, four 48-inch culverts would be required through the levee. These structures would be reinforced concrete circular pipe equipped with flap-gates to prevent backup during periods of high water level in the main channel. Secondly, the suggested levee intersects two major roadways, Milton Road and East Broadway (Illinois Route 143). The existing levee on the east bank of the river provides closable floodwalls for each of these streets. The proposed levee on the west bank would require two similar structures.

Preliminary Economic Analysis--Eastern Alton Levee - A generalized economic analysis is based on construction costs for the above-described levee and estimated average annual damages which could be prevented by the measure. For the initial analysis two additional costs were not included due to detailed variables beyond the practical scope of the study. One of these costs is that of right-of-way acquisition. Total right-of-way area necessary would be approximately five acres. Secondly, upon completion of the levee an annual cost would have to be incurred for maintenance of levee cover, flap-gates and closable floodwalls. Therefore, the initial analysis primarily deals with the total first costs of the project and the estimated annual average flood damages. Construction costs for the levee and appurtenant structures are $164,900 including engineering, legal and administrative costs and a 10 percent contingency. With an economic life of 100 years, the investment is amortized to an annual cost of $10,127.

Approximate values were established for the structures within the area of potential protection, and the basic Federal Insurance Administration formulas were applied to obtain average annual flood damages. This approximation method indicates that annual damages prevented would be more than 50 percent greater than the annual cost.

Based on this preliminary economic feasibility analysis, it appears that levee protection for the described area is economically favorable. However, a more detailed analysis is required to determine the exact benefit-cost ratio.

WB - Burlington Drive Levee

The second developed area in the Wood River Basin identified in a potential flood area is located on the west bank of the West Fork of the Wood River immediately north of Illinois Route 111. Eight structures lie within the potential flood area resulting from the 100-year rainfall event. Six of the eight structures are residential and two are commercial establishments. Total potentially floodable land area around this development is 23 acres.

To prevent flood damage from occurring to existing buildings in this area a levee would be required. The results of the TR-20 and WSP-2 computer program analysis indicate a peak flood elevation of 458.9 feet above sea level in this area during the 100-year rainfall event. The length and height of a levee to protect the area would be 2,500 feet and 12 feet respectively. The levee would be constructed with a 4-foot crown, 32-foot wide base and levee side slope of 1:3.

Required appurtenant structures include three 48-foot reinforced concrete culverts fitted with flap-gates. These culverts would permit drainage of runoff from the protected area to the main stream. During blocked drainage conditions, some runoff would collect behind the levee. However, no damage is expected from this since blocked drainage is a short-term conditions at this point on the main stream.

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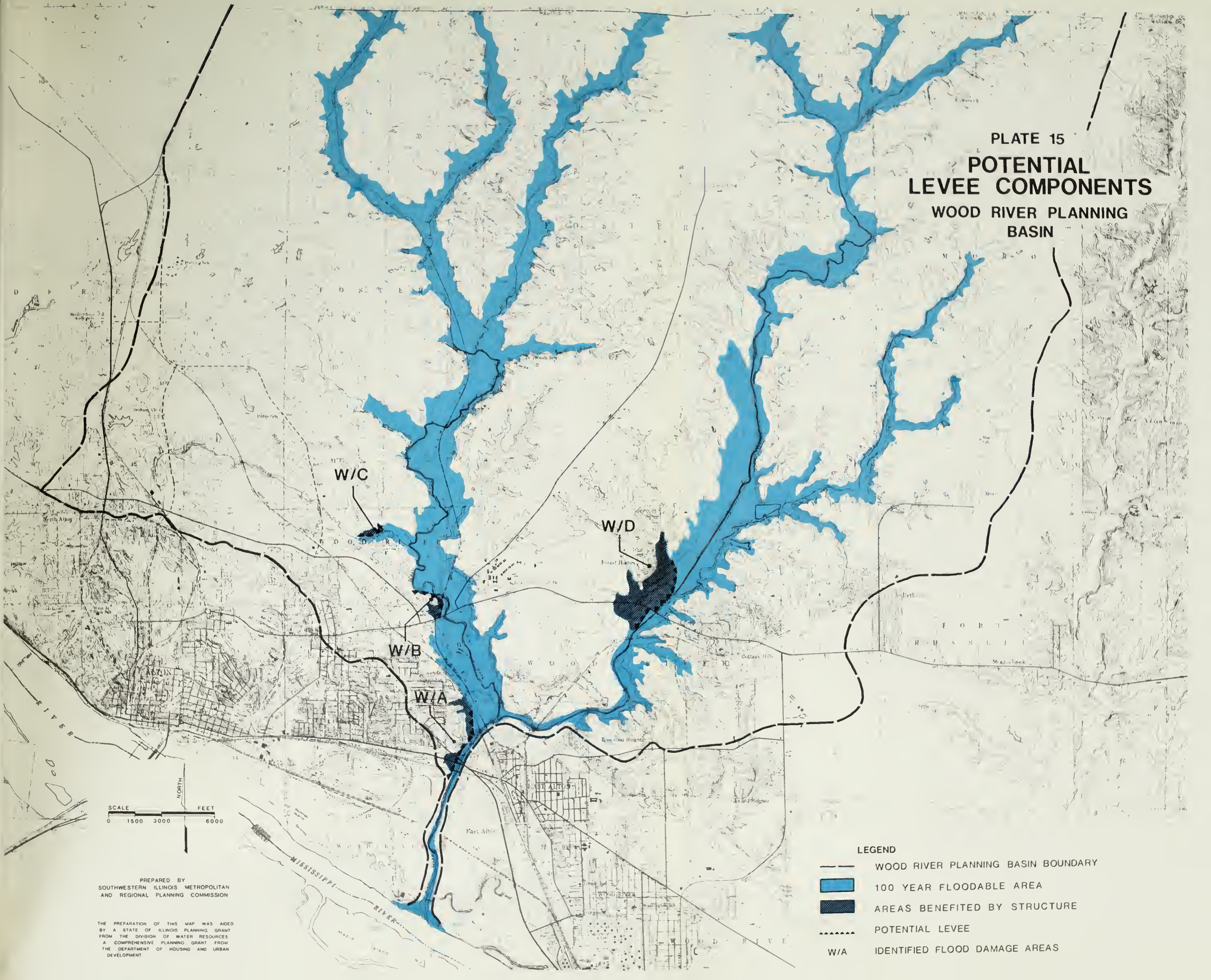

PLATE 15

POTENTIAL LEVEE COMPONENTS

WOOD RIVER PLANNING BASIN

LEGEND

— —	WOOD RIVER PLANNING BASIN BOUNDARY
🟦	100 YEAR FLOODABLE AREA
▨	AREAS BENEFITED BY STRUCTURE
▴▴▴▴▴	POTENTIAL LEVEE
W/A	IDENTIFIED FLOOD DAMAGE AREAS

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SOUTHWESTERN ILLINOIS METROPOLITAN
AND REGIONAL PLANNING COMMISSION

THE PREPARATION OF THIS MAP WAS AIDED BY A STATE OF ILLINOIS PLANNING GRANT FROM THE DIVISION OF WATER RESOURCES A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

eliminary Economic Analysis--Burlington Drive Levee - Generalized total costs the Burlington Drive Levee were calculated on the basis of standard unit costs r earthen levee construction and reinforced concrete circular pipe. Utilizing ese base unit costs, the total project cost was established including construc- on costs; engineering, legal and administrative costs; and a 10 percent contin- ncy allowance. Total cost for the project is approximately $76,500. Utilizing rrent interest rates this can be translated into an average annual cost of ,700, based on a 100-year economic life.

rough field survey and examination of assessment records, market value estimates re made for the eight structures in the floodable area. Utilizing the Federal surance Administration's tables and formulas for flood insurance rates, the total erage annual damages were calculated for the area to be protected by the above- scribed levee structure. It was determined that average annual damages amount to ly about one-half of the estimated annual costs. It does not, therefore, appear at flood protection of this area by the levee structure considered would have a vorable benefit-cost ratio.

- Mission Road Levee

the northeast portion of the City of Alton lies the third identified area of tential flood damage to structural development. Twenty-eight residential struc- res, which include the newest structures with the highest market value of all the sidential areas identified in the delineated flood areas of the basin, are lo- ted along Mission Road. The potential flood area surrounding structures consti- tes a total of 17 acres.

ood protection for this area could be provided by the construction of a relative- small earthen levee 1800 feet long and 10 feet high, with a 4-foot crown, 44- ot base and 1:3 side slope. The levee would provide protection from flood eleva- ons up to 450 feet above mean sea level. In order to allow storm water runoff om the protected area to drain into the main channel, one 3-foot culvert would be quired in the levee.

eliminary Economic Analysis--Mission Road Levee - Utilizing the basic method scribed in previous discussions concerning levee construction, the total project st for the Mission Road Levee, including levee and culvert construction; engin- ring, legal and administrative costs; and a 10 percent contingency allowance was timated at $34,000. By amortizing for a 100-year economic life, the estimated nual cost would be slightly more than $2,000.

ain utilizing the FIA flood insurance rate methods and estimated structural lues, a value was determined for average annual flood damages expected from the evation of the 100-year event. This value was found to be in excess of four times e annual cost of the levee structure. It is therefore very probable that de- iled economic analysis would result in determining a very favorable benefit-cost tio for this structural element.

WD - Forest Homes Levee

The fourth and final area of floodable development identified in the Wood River Basin is the unincorporated urban development known as Forest Homes. This development is located on the west bank of the East Fork and the north side of Illinois Route 140. Approximately 155 acres of this area and more than 100 residential structures lie within the floodable area of the 100-year rainfall event.

The existing levee on the west bank of the East Fork terminates approximately 500 feet south of Highway 140. Protection for the Forest Homes area could be provided by extending the existing levee northward to a ridge located immediately northeast of the potential flood area of the Forest Homes development. A levee approximately 5,000 feet long and 12 feet high would protect the area from flooding up to 463 feet above mean sea level (100-year rainfall event). With a levee crown of 8 feet in width and a levee base 56 feet wide, the levee side slope would be 1:3.

In addition to the earth work for the levee itself, the installation of structures to provide drainage of storm water runoff from the protected area would also be required. The hydrologic and hydraulic analyses of interior runoff indicate that three 48-inch culverts would be required. The most practical type of culvert would probably be reinforced concrete circular pipe fitted with appropriate flap-gates.

Preliminary Economic Analysis--Forest Homes Levee - To determine an estimated benefit-cost ratio, the cost of the Forest Homes Levee was calculated utilizing unit construction costs and the prescribed levee size. Secondly, average annual damages were estimated based on approximate structural market value and the FIA flood insurance rate tables and formula.

Total estimated project costs which include construction costs for the levee; culvert costs; engineering, legal and administrative costs; and a 10 percent contingency allowance amount to $156,000. When amortized, based on a 100-year economic life, the average annual cost is found to be $9,600.

In comparison to the annual costs for the project, the average annual damages which would be prevented are slightly higher. It, therefore, appears that this levee project for the Forest Homes area would have a favorable benefit-cost ratio.

Environmental Assessment of Potential Levees

The planned construction of the Eastern Alton, Mission Road, Burlington Drive and Forest Homes Levees located along Wood River and the West and East Forks of Wood River will be built on relatively similar sites and have relatively similar environmental impacts. The levees will be constructed on Wakeland-Haymond alluvial association soils. These soils are generally ill-suited for levee and embankment construction because of poor stability and poor resistance to piping. Great care should be exercised during the design and construction phase in order to avoid operational difficulties.

levees will be constructed predominantly in areas of old field habitat with
e scattered shrub and small tree vegetation. The Forest Homes Levee is an ex-
tion in that its construction will destroy a strip of dense forest habitat.
s forest area is typical of stream bottoms in the PIWOCA area. Tree species
lude silver maple, sycamore, cottonwood and American elm. During construction
y a small quantity of wildlife habitat will be lost, some small animals killed,
other displaced. These displaced animals will not survive in most cases due
the unavailability of new habitats. The forest strip lost with the Forest Homes
ee would be the most valuable habitat lost from levee construction. This loss
l be somewhat offset by its replacement with levee habitat after one or two
rs.

door recreation should be substantially unaffected by these projects. Since
hing is not an important recreational pastime in these river stretches, the
porary loss of stream access will be insignificant.

construction of the levees will result in some temporary noise and air pollu-
n associated with the use of heavy construction machinery and the dust from
th movements. The construction phase will add somewhat to the sediment load of
rby streams and cause some short-range biological damage to stream bottom life.

re are no known historic sites in the project areas. Wood River and its tribu-
ies are the focus of what appears to be a rich archeological area. Therefore,
rained archeologist should be hired to field check the sites prior to construc-
n.

and WF - East Fork and West Fork Dams

otential structural alternative to levee construction was considered for allevi-
on of urban flood damages in the Wood River Planning Basin. This alternative
olves the construction of large dams located upstream from the potential damage
as. It was determined that a single dam on either the West Fork or the East
k would not provide protection for all of the four identified potential flood
age areas. To provide a degree of protection for all of these areas would re-
re two dams (one on each Fork) or a combination of one dam and selected levees.

basic site selection for the dams was based upon two criteria: (1) proximity
the potential flood damage areas and to the high concentration of runoff, and
flood plain width from bluff to bluff. With respect to the first criterion,
s must be located upstream of potential structural damage areas, while at the
e time, must be located far enough downstream in order to detain flows suffi-
nt to significantly reduce flood elevations in the lower reaches of the main
nnel. With respect to the second criterion, it is desirable to locate the dams
re the flood plain is relatively narrow. This reduces the required overall size
the structure, and thus lowers costs.

ed on the above criteria, the site selected for an earthen dam on the East Fork
located 9000 feet upstream of Illinois Route 140. The required length of the
ucture would be 1800 feet with a height of 20 feet. The crest of the dam should

be a minimum of 20 feet to provide sufficient space for a roadway if necessary. The resulting base width, assuming a 1:3 side slope, would be 140 feet. In addition to the construction of the earthen dam, a spillway of reinforced concrete approximately 200 feet in length would be required. The resulting reservoir would have a total surface area of 414 acres.

The construction of the East Fork dam would significantly reduce flood elevations in the Forest Homes area, but would have only a slight effect on the elevation of flooding in the Alton area near Illinois Route 3 and Aberdeen Street. Almost no change in flood elevation would result in the Mission Road and Burlington Drive areas along the West Fork. Therefore, the construction of this dam alone would leave three of the four identified problem areas in need of protection from damages caused by overbank flooding.

Based on the same criteria, the site for a dam on the West Fork was selected 800 feet upstream from the confluence of Coal Branch Creek and the West Fork. The structural dimensions of this dam are basically the same as those described for the East Fork dam with the exception of length. The West Fork dam would be approximately 2,000 feet in length. As with the East Fork dam, the structure would require a 200-foot long concrete spillway. The surface area of the resulting reservoir would be 795 acres.

The reduction of flood elevations created by the West Fork dam would be sufficient to alleviate damages in the Mission Road and Burlington Drive areas. However, little or no protection would be provided for either Forest Homes or the Route 3-Aberdeen Street area.

In order for the dam alternatives to provide a degree of protection for all four identified problem areas, both the East and West Fork dams would be required.

Preliminary Economic Analysis--East Fork and West Fork Dams - To make an initial analysis of the economic feasibility of the dams, the basic construction costs for each dam were calculated. The initial cost includes: earth work; spillway construction; engineering, legal and administrative costs; and a 10 percent contingency allowance. The total first cost for the East Fork dam would be approximately $2.25 million, and the cost of the West Fork dam would total $2.75 million. When amortized for a 100-year economic cost the annual costs for the dam construction would be $138,000 and $140,000 for the East Fork and West Fork dams respectively.

By combining the total average annual damages from previous assessment in the problem areas which would be protected, it was possible to estimate the benefit-cost ratio for the dam components. It was determined that this benefit-cost would be less than .1, which is considered economically unfavorable. Moreover, when cost of land acquisition for the reservoirs, which would be created by the dams, is considered the ratio is even more unfavorable. Furthermore, the stability of the loessal soils for dam structures has not been determined for these areas.

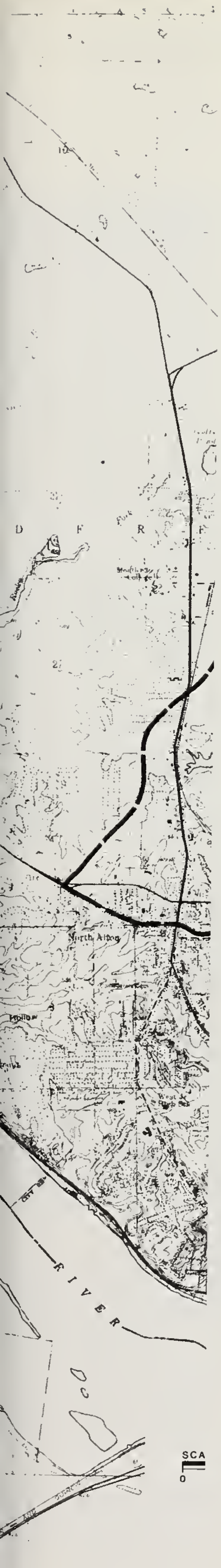

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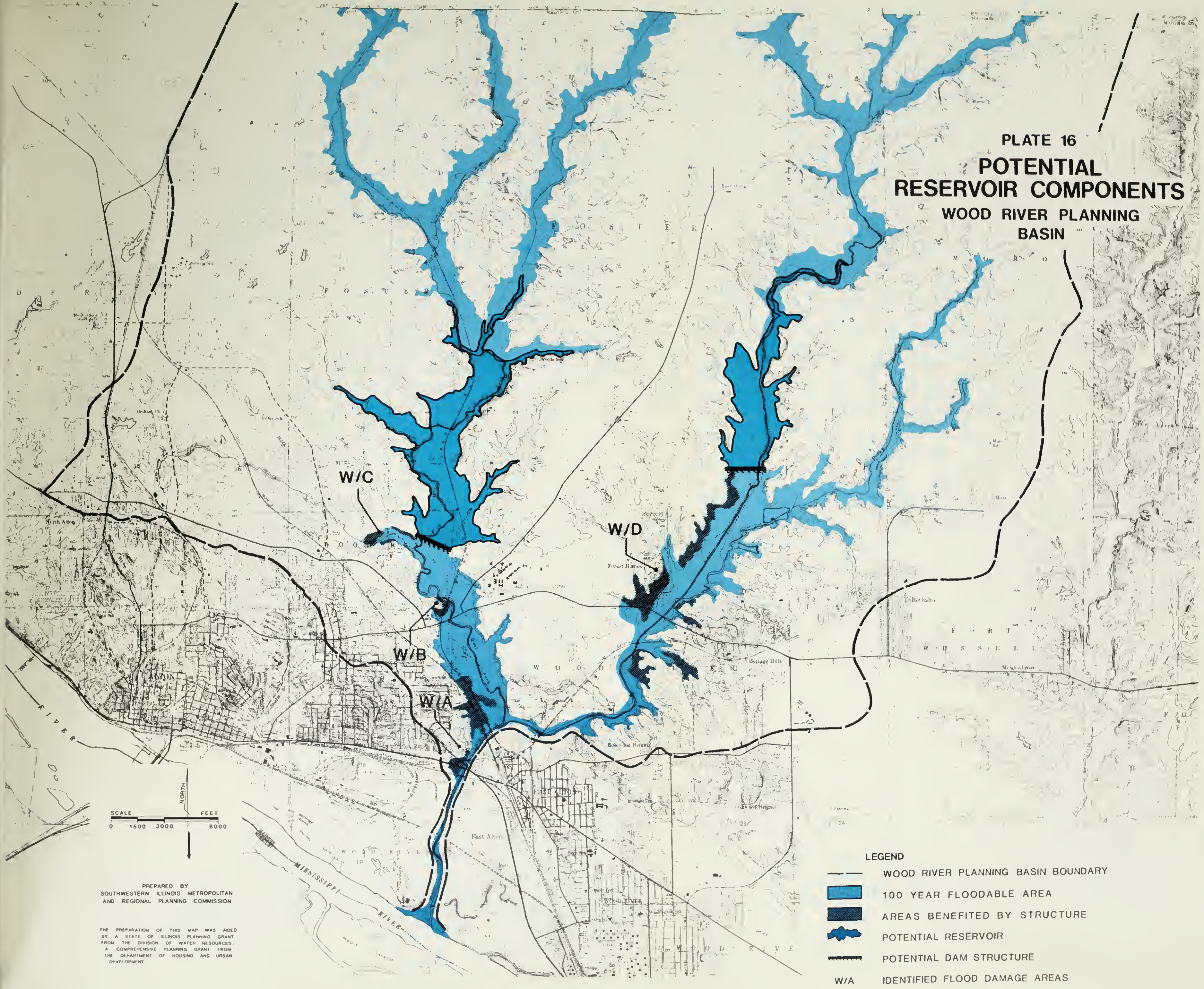
PLATE 16

POTENTIAL RESERVOIR COMPONENTS

WOOD RIVER PLANNING BASIN



LEGEND

— —	WOOD RIVER PLANNING BASIN BOUNDARY
🟦	100 YEAR FLOODABLE AREA
▨	AREAS BENEFITED BY STRUCTURE
●	POTENTIAL RESERVOIR
━	POTENTIAL DAM STRUCTURE
W/A	IDENTIFIED FLOOD DAMAGE AREAS

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AND REGIONAL PLANNING COMMISSION

THE PREPARATION OF THIS MAP WAS AIDED BY A STATE OF ILLINOIS PLANNING GRANT FROM THE DIVISION OF WATER RESOURCES. A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

vironmental Assessment--East Fork and West Fork Dams - The construction of the st Fork Dam and the East Fork Dam will create reservoirs of 748 and 455 acres spectively. This acreage will be permanently flooded.

e soils flooded will be in the Wakeland-Haymond association. These alluvial soils uld present a construction problem for the dam building due to their poor stabil- y and inferior resistance to piping. Extraordinary care in dam design and con- ruction will be necessary in order to insure the success of these projects.

ltivated field habitat will constitute the bulk of habitat flooded by the pro- cts. Both reservoirs will flood a strip of dense bottomland forest along the reams and the East Fork reservoir will flood a tract of approximately 40 acres. e forest habitat lost is very valuable wildlife habitat and would represent an portant diminution of habitat in the region. Most animals displaced by the rising ters would not be able to find new habitats because as they moved into new areas, ose animals already present would occupy the choice portions of the habitat. The jority of the habitat area lost would be of relatively small value for wildlife.

e creation of the reservoirs should in balance improve the aquatic habitats of e area by creating two large lake habitats. These lakes should provide habitats r a variety of fish and small animals. Currently, both branches of the Wood ver provide very little good habitat, In their present degraded conditions, eir loss would not be very serious.

ere are no known historic sites in the areas to be flooded but there are several spected sites. Because of the archeological value of the streams and adjacent eas in PIWOCA, more archeological research is needed before construction should allowed to proceed.

e direct economic costs of construction that have been discussed earlier in this apter omit costs resulting from flooding above the dam. A major economic impact ll result from the loss of hundreds of acres of good quality bottomland farmland d some associated farmsteads. Although this land is occasionally flooded, most the acreage is devoted to profitable cropland. As was also indicated earlier this chapter, the dams will provide flood protection to lands downstream from e dams.

e construction of the dams should result in a significant increase in outdoor ter recreation for the PIWOCA region. If game fish are stocked within the water dies, sport fishing should become established within a realtively short period. e to their limited use, the loss of the free flowing portions of the West and st Forks of Wood River will not be an important loss to the total fishing recrea- on of the region. Small pleasure boat use should also increase in the large kes behind the dams.

me short-range negative environmental effects will occur during dam construction. ese include increased noise, and sedimentation in streams below the dam.

POTENTIAL COMPONENTS - CAHOKIA CREEK PLANNING BASIN

Results of runoff analysis provided by the computer programs (TR-20 and WSP-2) in the Cahokia Creek Basin indicated that the 100-year rainfall event would cause the inundation of 12,600 acres of undeveloped land within the Madison County portion of the basin. It was, therefore, not considered economically advantageous to investigate structural measures for the reduction of overbank flooding. Considering current high costs of construction and the average amount of agriculture damage which might occur, it is not generally considered practical to attempt protection of agricultural areas through extensive construction. Moreover, a large portion of the 100-year flood area is not currently in economic production, but is land occupied by tree cover or open grassy area.

With the absence of urban type development in the 100-year flood area of Cahokia Creek, the most reasonable solution appears to be non-structural. Since no major damage areas exist within the flood area, it is most desirable to limit the creation of a potential flood damage area. There are several regulatory measures available which can accomplish this. The delineated flood area can be zoned through a county zoning ordinance in such a manner as to limit the usage of this land to those practices which would not suffer great economic losses by periodic inundation. These uses would include agriculture, timber, recreation and conservation (wildlife) Variances would be acceptable only if the applicant could verify that the proposed use would be carried out in such a manner so as to not create a significant potential flood damage.

A second non-structural approach could be in the form of subdivision regulations or construction regulations. If any area within the delineated flood area were to be used for uses such as residential or commercial, the developer must provide for adequate flood protection and sufficient drainage facilities. Specific regulation within building codes could include flood-proofing of all structures within the flood area.

Regulatory measures which would prevent future flood damage areas are exemplified in Appendix E of this report. The Model Ordinance gives specific examples of the non-structural approach to the prevention of flood damage.

Environmental Assessment--Cahokia Creek Basin - Proposed zoning and development restrictions for the more than 12,000 floodable acres of the Cahokia Basin would effectively safeguard agricultural and forest land. Most of the affected acreage is good agricultural land and a valuable regional resource. The forested banks and adjacent areas of bottomland forest provide a superior wildlife habitat. Along with the Piasa Basin, the Cahokia Creek Basin provides some of the most valuable wildlife habitat in the region. A variety of invertebrates and vertebrates make their homes in the basin's forests.

The basin includes some of the best archeological areas in the PIWOCA region and its protection would insure the perpetual retention of a valuable cultural resource.

ishing pressure in both Cahokia and Indian Creeks is very light. With good soil onservation practices to reduce excessive stream silting, programs to reduce acid ine drainage in Cahokia Creek, and fisheries management programs to create adequate ool depth and cover conditions, the streams could provide an important source of ecreation. In addition to its potential as a fishing area, the Cahokia Basin is urrently a good hunting area. The mix of habitats provide a good rearing ground or such small game animals as squirrels, rabbits and doves, as well as for an ccasional deer.

ne of the major flooding problems occurs to the east of the Chicago and Eastern llinois Railroad where a large area of more than 900 acres is flooded after a 00-year storm event. This area includes a portion of the meander belt along the ase of the bluffs. The more than 900-acre tract would form an important part of green belt buffer for the heavily urbanized areas to the west. This area is also n outstanding archeological area and the region's cultural heritage would benefit rom development restrictions. Finally, a tract of about 30 acres of prime bottom- and forest vegetation could be preserved. The tract, located to the east of the orfolk and Western Railroad would be a logical part of a conservation area that ould include upland timber on the bluffs as well as the bottomland vegetation.

merican Bottoms Area

he portion of the PIWOCA planning area known as the American Bottoms lies within wo of the three Planning Basins, the Wood River and the Cahokia Creek. The serious looding problems in this area are caused by interior flooding. Specifically, urban looding has for many years been a serious problem in the Wood River-East Alton area orth of Illinois Route 143, and widespread ponding and poor drainage is a serious roblem in the Grassy Lake area north of the Cahokia Diversion Channel. Previous nd current studies of these problems have been carried out by the Illinois Division f Water Resources and the U.S. Army Corps of Engineers.

he State of Illinois, through the Division of Water Resources, has extensively ex- mined the problem in the East Alton-Wood River area. As a result, a proposed pro- ect plan is currently in the pre-construction design stage with a construction tart anticipated during Fiscal Year 1977. The SIMAPC Surface Drainage Program for he PIWOCA area has accepted this project as the solution for the Wood River-East lton problem area. (For plan description see Appendix C.)

ith respect to the Grassy Lake problem area, a plan for the solution of interior looding problems in this area was recommended by the Corps of Engineers in 1962. For project plan description, see Chapter 2, page 14.) The District is currently eevaluating this structural system of ditches and pumping. In the event that this eevaluation indicates a favorable economic feasibility, the project appears to be he most reasonable and practical approach to the problem.

nvironmental Assessment--Grassy Lake Area - The three ditches will be constructed n gently sloping bottomland terrain. Soils are primarily included in the Darwin ssociation with the exception of a small zone of Wakeland-Haymond association soils along the ditch paralleling the Chicago and Eastern Railroad. Darwin association soils are poorly suited for drainage ditches. These soils have a silty clay surface layer and a silty clay subsoil. Permeability in the subsoil is poor. Darwin soils have fair to poor stability and compaction as well as high shrink-swell characteristics which are not advantageous for ditch construction. One serious problem associated with ditch construction is the presence of water-bearing sands beneath the Darwin soils. These sands are very unstable and if a ditch is dug into them, the collapse of the structure might result. A detailed site investigation to determine the exact depth of the sands beneath the Darwin soils should be made prior to ditch design and construction. Wakeland-Haymond soils would also present construction problems because of their poor stability and resistance to piping.

The habitats of the areas where the canals will be built are predominantly cultivated fields. There is also a small quantity of old field and small trees along the railroad right-of-way and the Cahokia Diversion Channel. These habitats are of relatively limited value for wildlife and its loss would not represent an important loss of this resource. More important is the potential draining of the marsh area north of Grassy Lake along Route 111. Although the ditch does not extend into the marsh itself, it is possible that it will drain the water from the area. The marsh is the only major marsh in the PIWOCA area and should be preserved not only as a valuable wildlife area but as an unique remnant of the region's natural heritage.

The eastern ditch cuts into the Wood River Terrace which is the most important area of archeological site concentration in the PIWOCA area. This ditch will cut through at least one large archeological site. The west ditch also cuts through a known archeological site. Because of the archeological importance of the area, more field study should be conducted before any construction is initiated. There are no known historic sites in the affected area.

SELECTED PLANS

7

HE RECOMMENDED PLANS

the planning process, several alternative solutions were developed for the major
ainage systems within the PIWOCA planning area. The alternative components,
scribed in Chapter 6, were carefully considered in different combinations. Each
mbination of components was examined as to its economic and functional efficiency
an alternative solution.

e to the land use characteristics in the delineated 100-year flood area of the
asa Creek and Cahokia Creek Planning Basins, the examination of extensive struc-
ral measures was not warranted. Thus, the number of alternative solutions for
ese two Planning Basins was minimal. However, in the Wood River Planning Basin,
veral areas of urban development were identified within the 100-year flood plain,
d several alternatives incorporating structural measures were considered. In
pendix B of this report, the twenty-nine alternative solutions developed for the
od River planning area are presented in tabular form in Table B-1. Not all of
e alternatives presented would provide total protection for all areas of existing
velopment within the 100-year flood plain. However, all alternative solutions
ich provided any degree of protection for the identified areas of potential urban
ood damage were considered.

ELECTION PROCESS

on completion of the hydraulic and hydrologic analyses, the basic structural com-
nents (Chapter 6) were designed and incorporated into the basic alternative
lutions. A preliminary economic feasibility analysis was then conducted for each
mponent, and these analyses were then applied to each alternative solution con-
sting of from one to six components.

e basic economic feasibility analysis involved the calculation of the average
nual cost, average annual benefits derived, and the ratio between these benefits
d costs. Construction costs were based on current unit costs for earth work re-
ired in the construction of levee and dam structures, and current unit costs for
ncrete culverts and reinforced concrete structures, such as dam spillways. The
tal construction cost was then translated to annual costs based on a 100-year
onomic life and an interest rate of 6 1/8 percent (resulting amortization rate is
61415). To estimate the annual benefits derived, it was necessary to estimate
e average annual flood damages which would be alleviated. In order to determine
e annual damages, the number, type, and approximate market values of structures
be protected were determined. This data was then utilized in conjunction with
e Federal Insurance Administration's flood damage factors to determine average
nual damages. In each case where the average annual flood damages alleviated
enefits) exceeded the annual cost of the structural component, the alternative
s identified as being economically favorable, and in each case where annual costs
ceeded benefits, the component was considered to be economically unfavorable.

e prepared alternative solutions and their preliminary economic analyses (benefit/
st ratios) were presented to the Environmental Agency Advisory Committee, the
chnical Advisory Committee, and the Basin Advisory Committee (these Committees

are identified in Chapter 1 of this report). The three Committees in turn supplie additional information in terms of: (1) compatibility with activities of state an local agencies in the planning area, (2) engineering feasibility, and (2) the need of the local people within the PIWOCA planning area.

The selection process culminated in SIMAPC's review of the alternatives with consideration of the benefit/cost analysis and the information provided by the Committees. The result of this process provided the recommended plan for the PIWOCA planning area which provides the greatest benefits in comparison to cost, while meeting the needs of the people of the planning area. The following portion of th chapter provides a description of this recommended plan for the major drainage systems of the PIWOCA planning area.

PLANS FOR THE MAJOR DRAINAGE SYSTEMS

The recommended plan for the PIWOCA planning area specifically addresses four geographic areas: (1) the Piasa Creek Planning Basin, (2) the Wood River Planning Basin, (3) the Cahokia Creek Planning Basin, and (4) the American Bottoms portion of the planning area, which includes portions of the Wood River and Cahokia Creek watersheds. The recommended plan is presented herein, by each of the four areas.

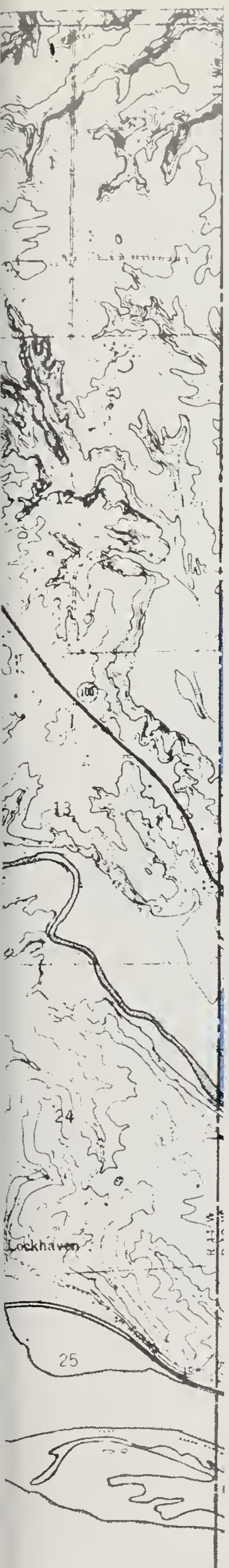
Piasa Creek Planning Basin

As previously explained in this report, no areas of urban development were identified within the 100-year flood plain of the Piasa Creek planning area. No structural measures are therefore recommended, as they cannot be economically justified based on current activities in the floodable area. However, creation of development which could create potential flood damage should be regulated or prevented through non-structural measures.

It is recommended that those governmental entities with appropriate authority (see Appendix D) should closely examine available regulatory measures (including the Model Ordinance presented in Appendix E) and implement the most suitable regulatio to regulate or prevent development in the flood plain which could potentially be damaged by the 100-year flood. The delineated 100-year flood plain is shown on Plate 17.

Wood River Planning Basin

The recommended plan for the Wood River Planning Basin includes three structural components, as well as selected non-structural measures. The following is a brief description of the recommended measures. Further explanation is presented in Chapter 6 for the structural measures and in Appendix E for non-structural measure. The recommended solution also appears as Alternative 7 in Table B-1, Appendix B. The location of recommended measures presented in the following paragraphs is illustrated in Plate 18.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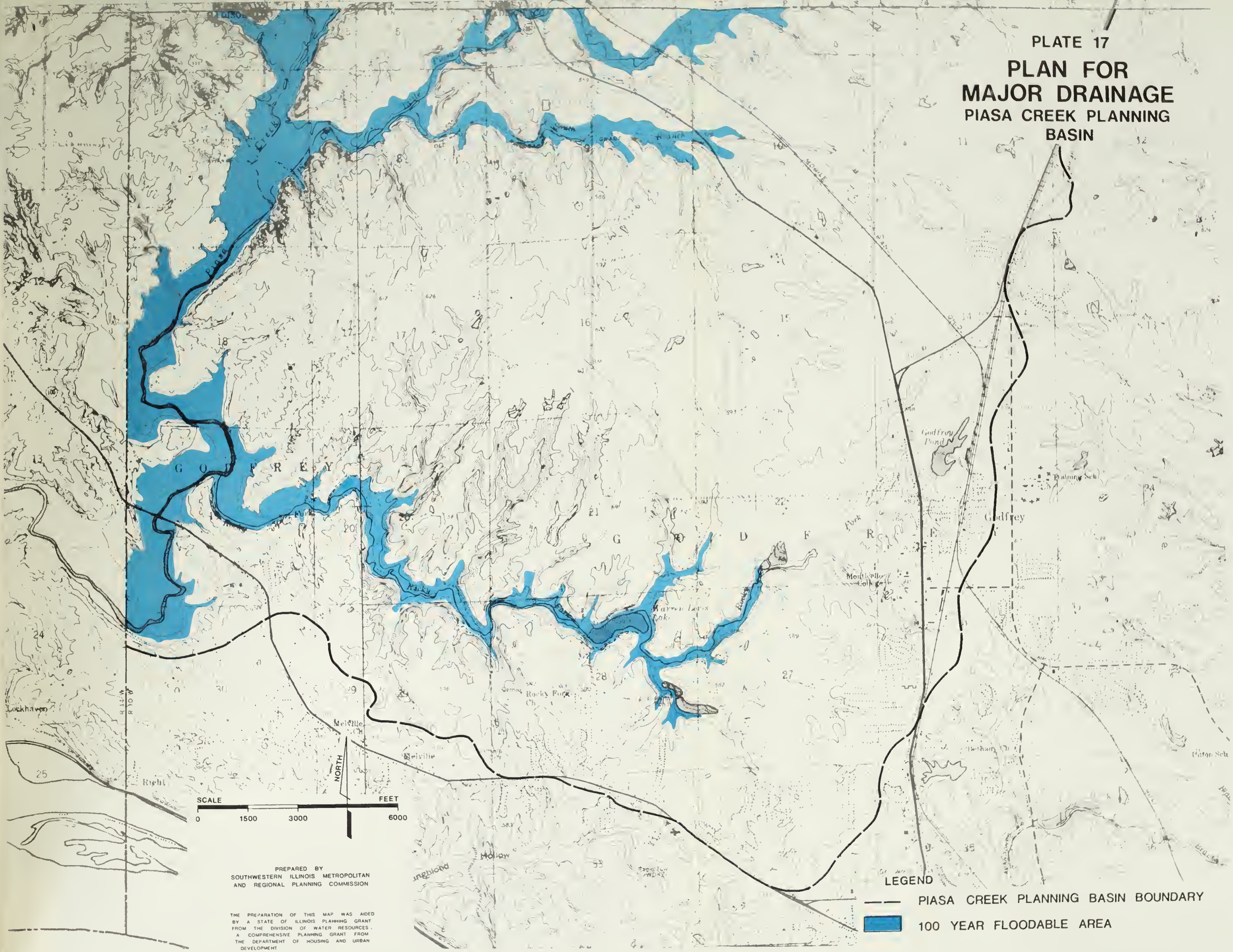

PLATE 17

PLAN FOR MAJOR DRAINAGE

PIASA CREEK PLANNING BASIN

LEGEND

— — PIASA CREEK PLANNING BASIN BOUNDARY

▇ 100 YEAR FLOODABLE AREA

PREPARED BY
SOUTHWESTERN ILLINOIS METROPOLITAN
AND REGIONAL PLANNING COMMISSION

THE PREPARATION OF THIS MAP WAS AIDED BY A STATE OF ILLINOIS PLANNING GRANT FROM THE DIVISION OF WATER RESOURCES, A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

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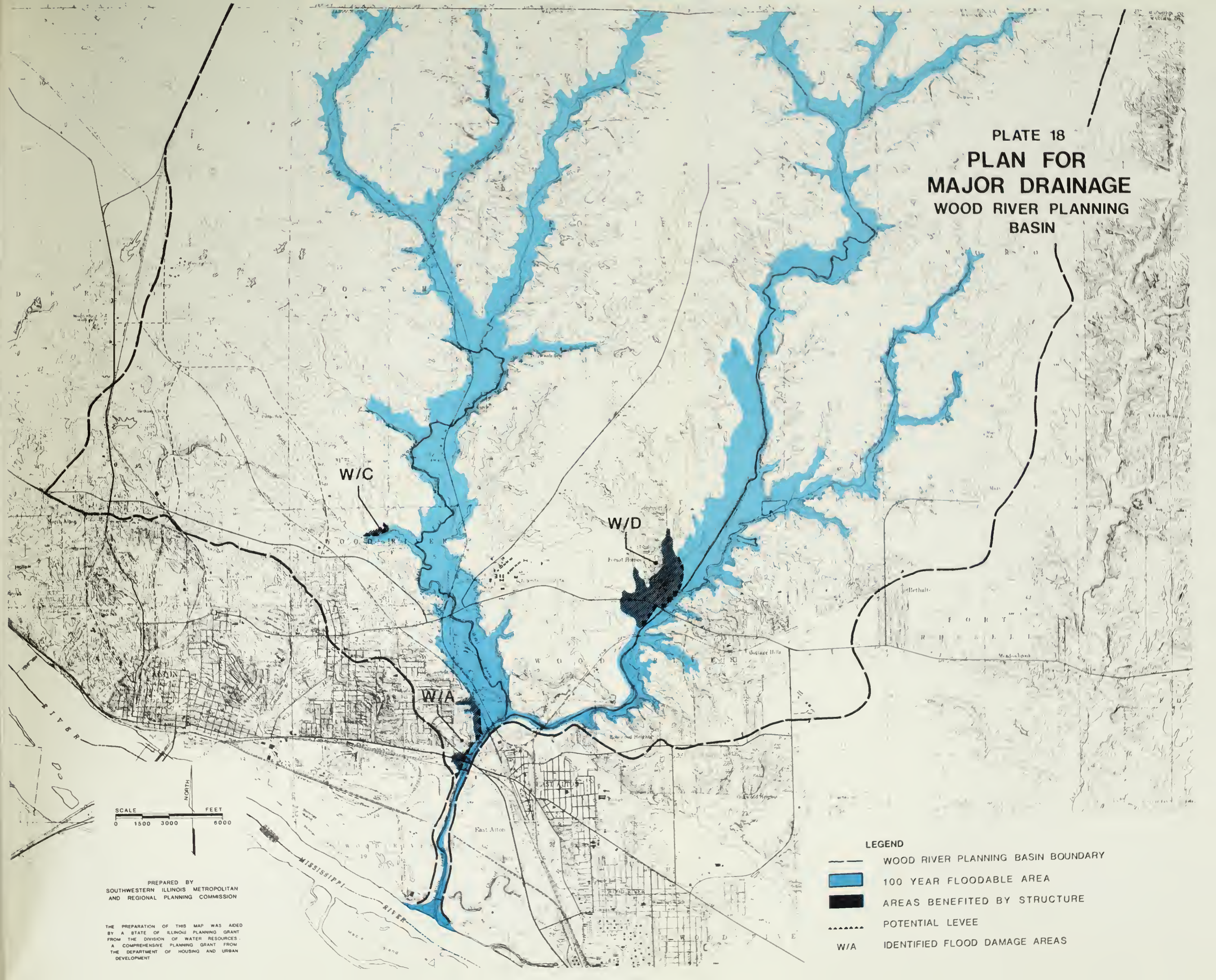

PLATE 18

PLAN FOR MAJOR DRAINAGE

WOOD RIVER PLANNING BASIN

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- Eastern Alton Levee - It is recommended that appropriate actions be initiated the Wood River Planning Basin which will result in the construction of the prosed levee structure from Illinois Route 3 to Aberdeen Street in the eastern poron of the City of Alton. The preliminary economic analysis indicated that this oject would have a benefit/cost ratio well in excess of 1.0.

is required that prior to construction, assurances be given by the appropriate thority for the maintenance of levee, culverts, and flap-gates.

e structure, as described, is intended to provide protection for fifty-eight isting commercial and residential structures. It is not the intent to encourage ditional development in adjacent peripheral areas where the extent of flooding questionable.

- Mission Road Levee - It is recommended that the levee structure to provide e development on Mission Road in northeastern Alton with 100-year flood protection implemented. Due to the relatively small levee required and the relatively rge amount of average annual flood damage for the twenty-eight residences, the onomic favorability is the highest of all considered components. As with other ructures of the recommended plan, assurances for operation and maintenance are quired before construction to insure continued efficient functioning of the proctive structure.

- Forest Homes Levee - The largest development area identified within the 100ar flood plain is within the area known as Forest Homes, and it is recommended at the proposed levee structure for this area be installed. In view of the avere annual flood damages to the 100 plus residences, it would be economically vorable to provide this type of structural measure, along with assurances of intenance and operation.

sts: In considering the three structural components of the above recommendation, e total initial capital cost would be approximately $355,000. This would result an annual cost of approximately $22,000. The expected average annual benefits uld exceed this annual cost by approximately 70 percent, which indicates an onomically favorable project.

n-Structural Measures - It is further recommended that, in addition to recomnded structures, governmental entities with appropriate authority in the Wood ver planning area consider the available measures for regulating future developnt in the delineated 100-year flood plain. Considered regulatory measures should clude zoning, subdivision regulations, building codes, and other construction dinances. It is suggested that the Model Ordinance presented in Appendix E of is report be given careful consideration as a basis for the creation and implemention of appropriate regulatory measures.

Cahokia Creek Planning Basin

As previously discussed, the delineated 100-year flood plain of the Cahokia Creek does not encroach upon any areas of concentrated urban development. It is, therefore, recommended that the only measures to be taken are those to regulate future development in the identified flood areas shown in Plate 19. This can be accomplished through the implementation of ordinances including any one or all of the following: (1) zoning, (2) subdivision regulations, and/or (3) building construction regulations. The Model Ordinance in Appendix E includes measures which are considered to be extremely appropriate for the PIWOCA planning area, and it is recommended that the Model Ordinance be given full consideration by the county and concerned municipalities.

American Bottoms Area

The American Bottoms area north of the Cahokia Diversion Channel encompasses portions of the Wood River and Cahokia Creek Basins and areas which are drained directly to the Mississippi River (see inset, Plate 19). The area of the American Bottoms is herein addressed separately from the major Planning Basins in that it is: (1) of a homogeneous nature with respect to drainage, and (2) current drainage activities by other agencies are of major significance in this area.

Wood River-East Alton Plan - The State of Illinois Division of Water Resources has recently completed a drainage plan for the Cities of East Alton and Wood River. Implementation of the plan, as described in Appendix C, has been initiated. The elements of the plan appear in the inset - Plate 19 and Plate C-1. It is recommended that the local authorities pursue and follow to completion this plan.

Grassy Lake Area Plan - In 1962, the U.S. Army Corps of Engineers, St. Louis District, documented a plan for a system of three ditches and a pumping station to provide drainage for the Grassy Lake area along Illinois Route 111 north of the Cahokia Diversion Channel. The system appears to be a suitable structural solution for that area. However, the economic feasibility of that project has not been verified for present conditions. The Corps of Engineers is presently reevaluating this project's feasibility and any further recommendations are pending the results of that study.

Additional Recommendations - Drainage problems in the American Bottoms which are not addressed by the East Alton-Wood River plan or the Grassy Lake plan are currently not thoroughly identified or analyzed. It appears that these areas, especially the bluff meander belt area between Wood River and the bluff line, are in need of development regulation to prevent further damage. However, it is recommended that future studies be undertaken in the near future to provide a more detailed information base on which to design proper regulations.

PLATE 19

PLAN FOR MAJOR DRAINAGE

CAHOKIA CREEK PLANNING BASIN

LEGEND

- — — CAHOKIA CREEK PLANNING BASIN BOU
- ▨ 100 YEAR FLOODABLE AREA
- ▲▲▲▲ EXISTING LEVEE
- ━━ CHANNEL IMPROVEMENT
- ┅┅ NEW CHANNEL
- ■ PUMP STATION
- ▨ DETENTION AREA

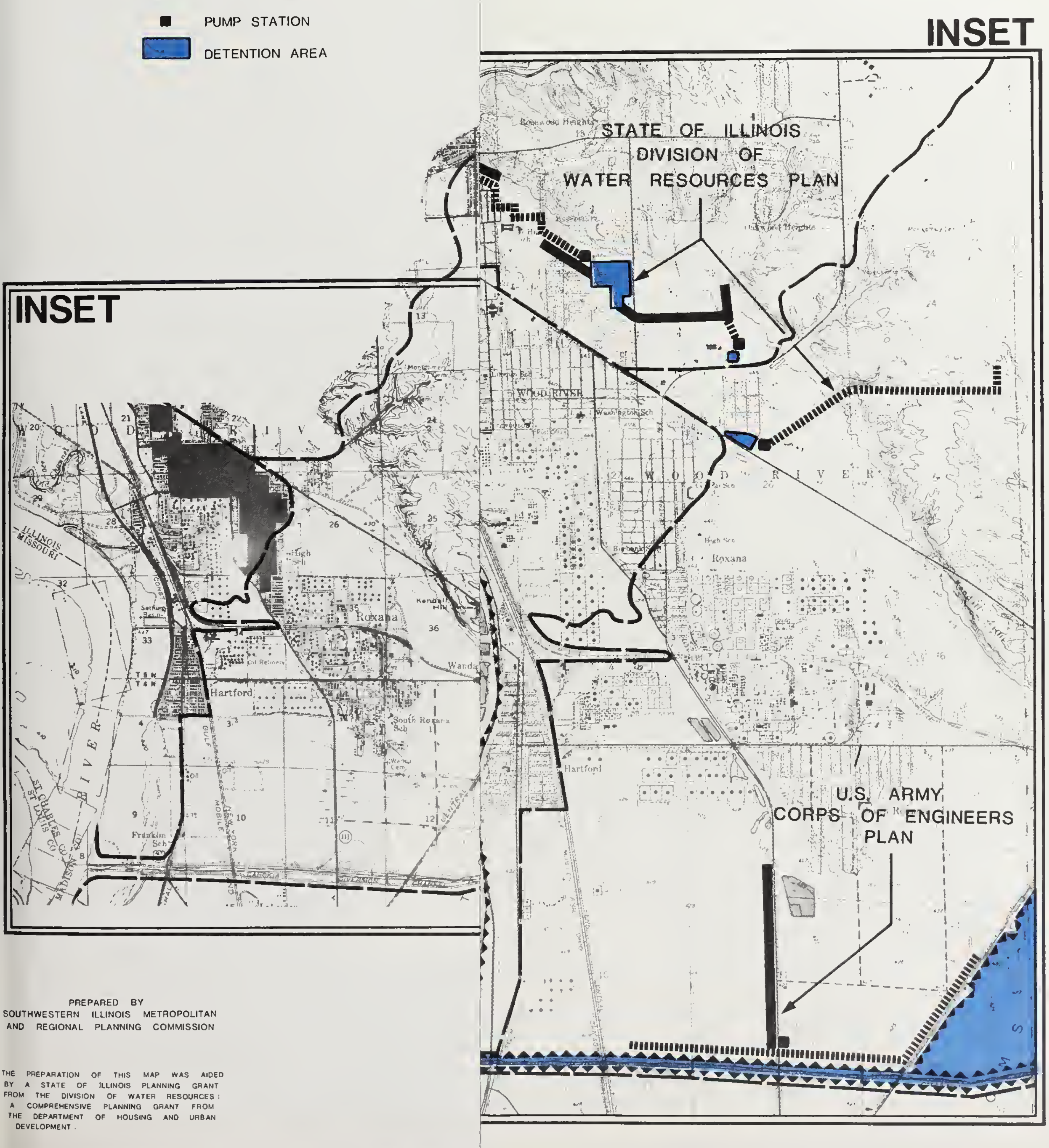

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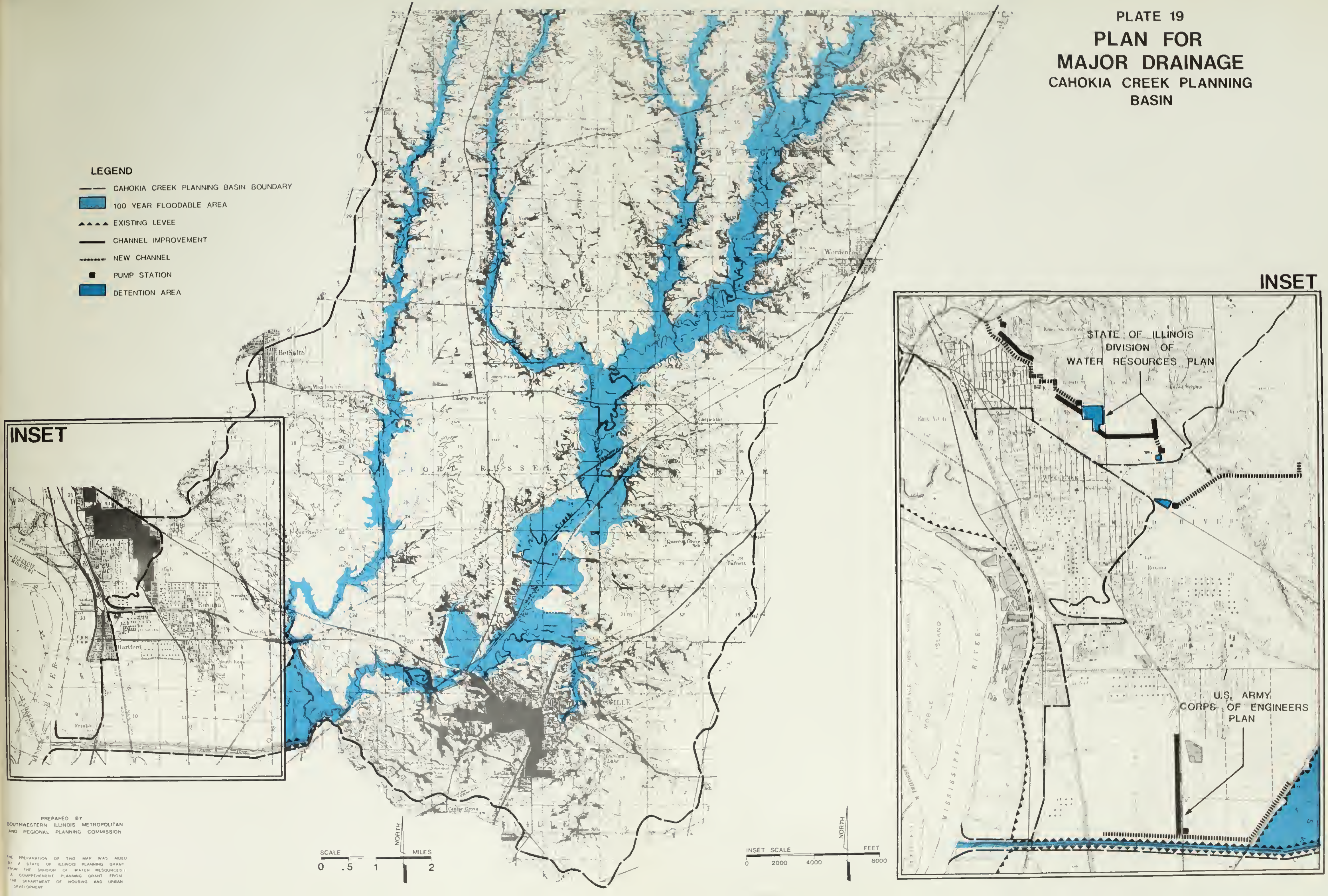
PLATE 19

PLAN FOR MAJOR DRAINAGE

CAHOKIA CREEK PLANNING BASIN



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IMPLEMENTATION STRATEGY

8

IMPLEMENTATION STRATEGY

The selected major drainage plans for the PIWOCA planning area (the Madison County portion of the Piasa Creek, the Wood River, and the Cahokia Creek Planning Basins), as described in Chapter 7 of this report, provide a design for attaining an effective storm and floodwater management program. The plans emphasize the necessity of coordinating flood control efforts with area drainage management measures through four major actions:

- Correction of present flood problems by a coordinated program of structural and non-structural measures;
- Regulation, in the public interest, of the use of private lands lying in areas subject to periodic flooding;
- Regulation of urban development in lands with drainage problems;
- Organization and management to provide for: maintenance and protection of drainage systems, floodproofing, and National Flood Insurance.

In a practical sense, the plans are not complete, however, until the steps required for plan implementation--that is, to convert the plans into action policies and programs--are specified.

Plan implementation measures must grow not only from the adopted plans, but also must be based upon a full understanding of the findings and recommendations contained in all elements of the basin plans. Thus action policies and programs must proceed from plan adoption to implementation of the most important elements of each plan with emphasis placed on those areas of action which will have the greatest impact on guiding and shaping the overall development of the PIWOCA planning area.

This chapter is presented as a guide for the implementation of the three major drainage plans for the PIWOCA area. Basically, it outlines the actions which must be taken by the various concerned levels and agencies of government to assure that the proposed non-structural (regulatory) and structural elements of the plans as well as the necessary studies and plan detailing will be carried out. Major topics discussed in this chapter include:

- Identification of those governmental units and organizations which have plan adoption and plan implementation powers;
- Specification of necessary or desirable formal plan adoption actions;
- Recommendation of specific implementation actions;
- Discussion of financial and technical assistance programs available to the several levels of government in the implementation of the plans.

The plan implementation recommendations contained in this chapter are, to the maximum extent possible, based upon existing governmental programs and are predicated upon existing enabling legislation. Because of the ever-present possibility of unforeseen changes in economic conditions, state and federal legislation, case law decisions, governmental organization, and tax and fiscal policies, it is not possible to declare unconditionally exactly how a process as complex as plan implementation should be administered and financed.

REQUIREMENTS FOR PLAN IMPLEMENTATION

Continuing Plan Preparation

It is essential that some elements of the Major Drainage Plans be carried into greater depth and detail for sound implementation, including (1) data inventory, (2) plan design, and (3) plan implementation. In addition, further study is neede (1) to provide a basis for secondary drainage system planning, (2) to delineate th actual geographic limits of flood hazard areas in the American Bottoms, and (3) to provide a more detailed and specific data base for regulatory controls which best fit local conditions. Completion of these studies and preparation of such detailed plans could most readily be achieved through the continuing development of very close working relationships among SIMAPC, the counties concerned, local units of government, certain special-purpose districts, and various federal and state agencies.

It is important that local public officials and concerned citizens recognize that the failure to implement the recommended non-structural elements as well as the selected structural elements of the plans necessary to an effective storm drainage management program will proportionately lower the value of the PIWOCA planning are not only in terms of providing a livelihood for its people but also in terms of providing a pleasant, safe and healthful place in which to live. In addition, it is essential that the state and federal implementing agencies recognize that the PIWOCA planning area concerns a part of the State of Illinois wherein resides a large concentration of people, where the degree of natural resources base destruction has been great, and where existing demands on the resource base are high.

Additionally, it may be highly desirable to achieve a high degree of plan implementation through fulfillment of the SIMAPC function as a center for the coordination of local, regional, state, and federal planning and plan implementation activities within these Planning Basins and others which lie within its seven-county planning area. The community assistance program, through which SIMAPC upon request activel assists the local municipalities in the preparation of local plans and plan implementation devices; and the A-95 review process, through which SIMAPC reviews, comments, and makes recommendations on local applications for federal grants, are important factors in this respect. If properly utilized, it will make possible th full integration of regional and local plans within the Planning Basins, adjusting the details of the latter to the broader framework of the former.

an Implementation Organizations

amination of the various agencies available under existing legislation to implent the plan, as documented in Appendix D, "Legal and Administrative Factors," veals an array of departments, commissions, and districts at all levels of governnt. These agencies include SIMAPC as a regional planning agency; general-purpose cal units of government, such as counties and cities; special-purpose districts, ch as drainage and sanitary districts; state regulatory bodies, such as the linois State Division of Water Resources; and federal agencies that provide finanal and technical assistance for plan implementation, such as the U.S. Army Corps Engineers, the U.S.D.A, Soil Conservation Service, and the U.S. Department of using and Urban Development.

cause of many varied agencies in existence, it becomes exceedingly important to entify those agencies having the legal authority and financial capability to plement most effectively the selected and recommended plan elements. Accordingly, ly those agencies whose actions will have significant effect, either directly or directly, upon the successful implementation of the plan and whose full cooperion in plan implementation will be essential, are discussed in this chapter. her agencies that in special circumstances may contribute to inventory, planning, d construction functions are identified in Appendix D. The agencies are, for nvenience, grouped by level of government; however, the interdependence between e various levels of government and the need for close intergovernmental coopera- on cannot be over-emphasized.

deral-Level Agencies - In general terms, federal agencies have no initial juris- ction or responsibility for local drainage programs or problems except as re- ested by state or local agencies. Federal agencies do have the capability to ovide financial support for planning and construction activities on local projects ich benefit the public-at-large. These federal agencies include: (1) U.S. partment of the Army, Corps of Engineers; (2) U.S. Department of Agriculture;) U.S. Department of Housing and Urban Development.

e Corps of Engineers' role in plan implementation in the American Bottoms portion the PIWOCA planning area through an authorized interior flood control project thin the boundaries of the Wood River Drainage and Levee District, is of major gnificance. The recommended plan to alleviate interior flooding in this area, documented in House Document No. 150 of the 88th Congress, First Session, 1963 s authorized for construction by the Flood Control Act of 1965. (For plan scription, see Chapter 2, page 14, of this report.) The project, essentially active since authorization, has recently received funding for pre-construction anning. According to Corps procedure, the project plan (recommended in 1962) and s economic feasibility are being reevaluated--a necessary step toward preparation a Phase I report. The future of the project will, to a great extent, depend on the results of this initial investigation.

e local sponsor, an agency which will provide prescribed local assurances, is sential to all Federal flood control projects. At the present time, the Wood ver Drainage and Levee District, through its letter of intent to provide local sponsorship for the current interior drainage project within its boundaries, is fulfilling this function. The importance of its continuation in this capacity cannot be over-emphasized.

Although completion of the Corps' Phase I report lies in the future, there are some indicators to its outcome. Changing physical and hydrologic conditions in the character of the project area, changes in public policy concerning flood control projects, current economic conditions, and the current activities of the State of Illinois in solving the interior drainage problems within the Wood River-East Alton area, are all factors which indicate project plan modification, a substantial increase in project costs, and increased difficulty in proving the economic feasibility of structural measures.

State-Level Agencies - State-level governmental agencies in general have capabilities to provide planning assistance, information, and coordination services for local drainage control projects. Where local projects provide regional benefits, the state agencies can provide financial assistance for the following services: information dissemination and planning guidelines; plan preparation, adoption and review; plan regulation and enforcement; program development and coordination; engineering and technical assistance; financing and funding; land acquisition; and construction.

Within the PIWOCA planning area, the State of Illinois, through its Division of Water Resources, is currently providing financial and technical assistance for the design and construction of storm drainage facilities in the Wood River-East Alton area. Local provisions for right-of-way acquisition and adequate and coordinated operation and maintenance of these facilities are important factors in the success of this State project.

Special Districts - Four special districts with authority and responsibilites related to flood control and drainage management have been organized within the PIWOC planning area. Three districts--the Foster Drainage and Levee District, the Cahok Creek Drainage and Levee District, and the Indian Creek Mutual Drainage District--were organized for local project purposes and have geographical jurisdiction over relatively small agricultural areas within the planning area.

The Wood River Drainage and Levee District has jurisdiction over the largest geographical area which includes major industrial areas and urban centers. Some of the structural elements included in the selected plan for the American Bottoms portion of the PIWOCA planning area lie within the jurisdiction of the Wood River District. Existing flood control facilities in this area are owned, operated, and maintained by this district. Details of additional authority and responsibilities of drainage and levee districts in the State of Illinois appear in Appendix D of this report.

Local-Level Organizations - In addition to federal, state, and special district roles, local organizations must play a major role in plan implementation. Many of iese local organizations currently have the authority to accept this role. County id municipal organizations now have planning and plan implementation powers, in- uding police powers, land acquisition, condemnation (eminent domain), and con- ruction (tax appropriation) powers which are necessary for implementation.

e organizational structures of the nine municipalities within the PIWOCA planning ea, as related directly or indirectly to storm drainage management and flood con- ol, have been identified in Appendix D. The existing organizations are not scribed in this chapter as their geographical jurisdiction does not encompass the tirety of or major portion of the major drainage planning area. Rather, these its of government are primarily responsible for secondary storm drainage manage- nt within their jurisdictions.

sponsibilities for storm drainage management are currently spread among city uncils, planning commissions, sewer and water authorities, offices and depart- nts of engineering, public works, streets, and sanitation.

commended Implementation Action by Local Government: It is recommended that all cal governmental entities located within the PIWOCA planning area formally accept e Major Drainage Plans described in Chapter 7 of this report. Local entities clude the Madison County Board; municipalities and city planning commissions; ainage and levee districts and other applicable water and sewer districts; and e Madison County Soil and Water Conservation District.

cal Organizational Changes for Implementation: Local agencies needed to implement th non-structural and structural elements of the Major Drainage Plans for the WOCA area are authorized under existing State Statutes. Although most of the quired agencies do exist in the planning area at the appropriate levels of govern- nt, organizational deficiencies exist within the current structure and authorities these local governments. The Major Drainage Plans must be implemented in several eas that may well extend beyond the limits of any one city or special district.

th county and municipal governments in the PIWOCA area have the authority required implement the non-structural elements (regulatory measures) called for in the jor Drainage Plan for each of the three PIWOCA Basins. However, the absence of a chanism to assure coordination in these implementation activities throughout each sin, constitutes a deficiency in the existing governmental structure.

e need for a coordinated effort in the development of regulatory measures, as well in the application of these measures throughout each drainage basin, cannot be er-emphasized. The need exists primarily because water does not respect man's litical boundaries, and man, for the most part, is totally unaware of water's tural drainage basin boundaries. The visable result of this polarization lies in e effect man's activities in one portion of a drainage basin have upon other rtions of the same basin. The failure of one existing entity to regulate develop- nt within the major stream floodway may, and usually does, cause an increase in ooding within the boundaries of some other entity.

The high costs involved in the construction of flood control facilities have resulted in the participation of federal and state funding and agencies in major flood control projects. Both federal and state flood control projects are dependent upon a local organization to sponsor the project and provide the necessary local assurances.

Within the PIWOCA planning area the role of local sponsor in the Corps of Engineers' project, as noted previously, lies with the Wood River Drainage and Levee District. If federal or state participation is anticipated in the implementation of structural elements of the plans which are not included in the Corps' project area, the responsibility of local sponsorship (under existing governmental structure) would lie with the county or a municipality.

In order to provide the organizational base to achieve maximum effectiveness in both the structural and non-structural elements of plan implementation, reorganization of governmental structures or the creation of a new agency should be considered. Actions which could be considered include:

- Creation of new agencies with drainage authority at the county level, and establishment of intergovernmental agreements with municipalities.
- Creation of new entities which have the managerial and fiscal authority to manage flood control, storm drainage, and other elements of water resource management for each Drainage Basin.
- Organization of River Conservancy Districts or Forest Preserve Districts.
- Expansion and refinement of authorities of existing drainage districts.
- The combination of any of the above and/or any other organization with drainage authority.

Upon creation of the above agencies or combinations thereof, the extent of responsibility must be clearly defined. Responsibility may extend to the primary drainage system, non-municipal secondary drainage systems, municipal secondary systems, or any combination of the three types of drainage systems.

In the event municipal drainage is not included in the responsibility of basin or county organizations, the municipalities must provide for the implementation of their secondary systems. These systems and municipal drainage management must be compatible with the adopted Major Drainage Plan. In relation to this action, it is proposed that the following be given full consideration:

- Municipalities review the present charters, powers, duties, and functions of their several agencies and offices involved in storm water drainage management and flood control functions; and

  - strengthen or broaden the duties, powers, and functions of existing agencies and offices, as appropriate;

  - within their jurisdiction, create bodies, now authorized by statute, which will provide all complementary and supplementary functions required to implement the plan.

- As a minimum, all these units of government should have a planning body, engineering capability, and an inspection capability adequate to implement portions of the plan which come within their purview and jurisdiction.

lan Acceptance, Integration and Implementation

cceptance, endorsement, or formal acknowledgment of the Major Drainage Plans for ne PIWOCA planning area by the local legislative bodies and the existing local, reawide, state, and federal level agencies concerned is highly desirable. This ill assure a common understanding between the several governmental levels and nable their staffs to program the necessary implementation work. In addition, ormal plan adoption may also be required for state and federal financial aid ligibility.

doption of a selected plan by any unit or agency of government pertains only to ne statutory duties and function of the adopting agencies, and such adoption does ot and cannot in any way preempt or commit action by another unit or agency of overnment acting within its own area of functional and geographic jurisdiction. hus, acceptance of the Major Drainage Plans by the county would make the plan pplicable as a guide, for example, to development of county park or highway ystems but not to any municipal street or park development within the county. To ake a plan applicable as a guide to municipal park and street development would equire its adoption by the municipality concerned.

pon adoption of a selected plan, structural implementation could be initiated hrough the implementing agencies previously discussed in this chapter. Structural lements of a plan can be implemented by the Corps of Engineers with the proper upport of the local people and their Congressional representatives.

ne non-structural elements or regulatory measures can be implemented through the uthorities of local organization. Among the implementation devices for non-tructural measures is the application of the local entities' power to control and use development through the adoption of appropriate zoning ordinances, including zoning district regulations and zoning district delineations. As an element of otal Basin Plans, zoning ordinances or amendments to existing zoning ordinances hould be adopted by the appropriate county and local units of government within ne Planning Basins so as to provide a clear indication of the intent to implement n effective storm drainage management program. Thereby a framework would be provided for other planning and plan implementation efforts (see Appendix E).

RECOMMENDATION FOR FLOOD CONTROL AND DRAINAGE MANAGEMENT IMPLEMENTATION

Alleviation of present-day flood damages will be achieved primarily through implementation of the selected major structural improvements. Development of additional flooding problems will be prevented primarily through the institution of sound floo plain management regulations. Adequate management of surface storm water runoff will be achieved locally through a combination of secondary drainage systems and implementation of regulations and codes to guide local drainage development.

Flood Hazard Area Regulations

It is recommended that the county and all municipalities within the PIWOCA planning area review plan recommendations and amend, as appropriate, their zoning ordinances to include special flood land regulations similar to those set forth in Appendix E. Such regulations can take the shape of overlay regulations, or can be comprised of special flood hazard area zoning. Either of these two approaches can be utilized to assure that the basic objective of flood land zoning is achieved. This objective being the reservation of lands in flood hazard areas for essentially open space use, such as agriculture. The essence of such zoning would be to prohibit further urban development in flood hazard areas and to regulate urban activities in the American Bottoms in order to reduce the flood hazard and preserve the existing floodwater storage capacity.

It is recommended that the county and all municipalities in the PIWOCA planning area undertake to include in their zoning, building, housing, subdivision and sanitary ordinances, as appropriate, regulations dealing with the control of seepage, sewer backup relief, and protection from overland flood flow for dwellings located in the flood lands. Such floodproofing regulations should supplement sound floodway and flood plain regulations in the zoning ordinances to prohibit further urban development of flood lands.

Flood Insurance

It is recommended that all eligible municipalities in the PIWOCA planning area seek to qualify for flood insurance under the National Flood Insurance Program administered by the U.S. Department of Houisng and Urban Development. Although flood insurance is available only to individual homeowners and small businesses, the initiative to become eligible for the sale of such federally subsidized flood insurance must be taken by each individual municipality and the county. It is important to note that, as a condition for eligibility under the federally subsidized National Flood Insurance Program, a local community must also adopt adequate land use control measures not only for those areas already developed in flood hazard areas but to prevent the development of new structures in the flood hazard areas. Thus, while the program is intended to reduce losses on existing development in flood hazard areas, it is, more importantly, also intended to discourage the unwise use of flood hazard areas not yet developed.

nds for Flood Control Works

is recommended that administration and engineering action be initiated by appro- iate local entities to preserve lands for construction of the recommended struc- ral plan elements. Locations are shown on Plates 17 and 18. Such reservations, implemented early, will assure minimal new development in these areas. While calities are suggested in the plan for reservation of lands for eventual con- ruction of detention basins, channels, floodways and levees, the final siting d required land takes will depend upon detailed designs.

nds with Special Drainage Problems

is recommended that all local governmental units within the PIWOCA planning area opt the model ordinance presented in Appendix E, or amend, as appropriate, their ilding codes to regulate development in flood-prone lands and lands with season- ly high water table and severe soil constraints as identified on Plates 7 and F-1 this report. Such regulations, if adopted in accordance with principles and commendations in Chapter 5, will ensure local development free of widespread ainage problems, through proper pre-construction investigation and design. These gulations must assure special attention will be directed to timely planning, land ading, basement design (and construction, if permitted), road design, and balance conveyance and storage in the drainage systems.

ructural and Non-Structural Measures

is recommended that the county, all municipalities, and special districts within e PIWOCA planning area review plan elements in Chapter 7 and pursue implementation the selected plan measures by utilizing the suggested implementation strategies.

is further recommended that the responsible organizations within or encompassing e PIWOCA area review the model ordinance presented in Appendix E and incorporate ose portions which can be most efficient in preventing further damage. These e the most immediate and effective measures directly available at the local vel.

lated Project Planning

is recommended that any public or private body constructing or financing any new tructure related in any way to the perennial stream channel system of the region sign and construct such structures in accordance with the facility standards of e adopted plan so that such construction will not cause significant backwater ffects upstream. Prior to construction, the design should be submitted to the sponsible department of the local governmental unit for review.

Erosion Control

It is recommended that the county and all municipalities within the PIWOCA planning area adopt ordinances or amend, as appropriate, their building codes to include special erosion control measures based on the information and recommendation set forth in Appendix I of this report. Particular consideration should be given to the prevention of damaging erosion during and following construction of major or minor facilities. Enforcement of these regulations will require a staff adequate to review plans prior to issuance of a construction permit and regular inspection of operations while they are in progress.

Inspection and Maintenance

It is recommended that the county, municipalities and special districts within the PIWOCA area review plan recommendations in Chapter 7 and implement scheduled preventative maintenance for all flood and drainage facilities in their jurisdictions. Although this recommendation is stated as a required administrative action, it is of equal importance with adoption and implementation of any of the foregoing ordinances, codes and regulations. Without proper and regular maintenance, no facility will fulfill its design function.

Basic Data Collection

Governmental units should adopt continuing mapping and water surface profile development programs. The program of flood plain mapping could best be executed at the county level with programs being combined with other mapping requirements at the municipal level. Financing also would be shared on a cooperative basis.

Copies of data obtained during investigations of shallow bedrock areas, whether performed by individuals or public agencies, should be deposited with the county for use in refining the map delineations of shallow bedrock areas.

SUBSEQUENT ADJUSTMENT OF THE PLAN

No plan can be permanent in all of its aspects or precise in all of its elements. The very definition and characteristics of regional planning suggest that a plan, such as a Major Drainage Plan, be viable and of use to local, state, and federal units and agencies of government, and be continually adjusted through formal amendments, extensions, additions, and refinements to reflect changing conditions.

Amendments, extensions and additions to a Major Drainage Plan will be forthcoming not only from the work of the Southwestern Illinois Metropolitan and Regional Planning Commission, under the continuing regional planning efforts, but also from state agencies as they adjust and refine statewide plans. Federal agencies will participate in adjustments to the recommended plan as national policies are established or modified, or as new programs are created, or as existing programs are expanded or curtailed. Adjustments also must come from local planning programs

ich, of necessity, must be prepared in greater detail and result in greater re-
inement of the regional plan. Areawide adjustments may come from subsequent
egional or state planning programs, which may include additional comprehensive or
ecial-purpose planning efforts, such as the preparation of regional or county
rk and open-space plans.

l of these adjustments and refinements will require the utmost cooperation by the
cal, region-wide, state, and federal agencies of government, as well as coordina-
ion by SIMAPC which has been empowered by Illinois Statutes to act as a coordinat-
g agency for programs and activities of the local units of government. To
hieve this coordination between local, state, and federal programs most effec-
vely and efficiently and, therefore, to assure the timely adjustments of the
gional plan, it is recommended that all of the aforesaid state, region-wide, and
cal agencies having various plan and plan implementation powers advise and trans-
t all subsequent planning studies, plan proposals, and plan amendments, and plan
plementation devices to the Southwestern Illinois Metropolitan and Regional
anning Commission for consideration for integration into, and adjustment of, the
sin plans.

HYDROLOGY AND HYDRAULICS

appendix a

METHODOLOGY

HYDROLOGIC PROGRAMS
TR-20, WSP-2

HYDRAULIC METHODS
AND
TECHNIQUES

HYDROLOGIC ANALYSIS

PIASA CREEK PLANNING BASIN

WOOD RIVER PLANNING BASIN

CAHOKIA CREEK PLANNING BASIN

YDROLOGIC AND HYDRAULIC TECHNIQUES

or the purpose of studying surface drainage in the Piasa Creek, Wood River, and ahokia Creek Basins, two computer programs have been selected to model hydrologic nd hydraulic effects. These are TR-20 and WSP-2, both of which are furnished and un by the U.S. Department of Agriculture, Soil Conservation Service.

TR-20: This program computes surface runoff resulting from a given rainstorm, taking into account land use, soil type, and antecedent moisture, and will route the resulting flow through a given system of stream channels and reservoirs, combining hydrographs from tributary areas and streams as required and then print out elevation and flow hydrographs for any number of selected cross sections or reservoirs.

WSP-2: This program computes water surface profiles in open channels, when given cross section and bridge restriction data and roughness coefficients. By computing profiles for a set of discharge values, it develops rating tables of flow versus elevation for each cross section as well as head loss through bridges and culverts.

. BASIC APPROACH TO USE OF PROGRAMS

A. Hydrologic data for areas of the watershed as well as assumed velocities in channel reaches (the latter entered as routing coefficients) are input to the TR-20; output is the discharge hydrographs along the creeks and river and their tributaries (Plate A-1).

B. Physical data (cross section dimensions, "n" values, and bridge dimensions) are input to the WSP-2, as well as assumed flows and starting elevations; output is a set of rating tables for various cross sections along the river and creeks.

C. Output from each program is then used to refine the input for the other. Rating tables from the WSP-2 program output are used to replace assumed routing coefficients in subsequent runs of the TR-20. Discharge values from the TR-20 output are used to replace assumed flows in the subsequent runs of WSP-2.

I. DISCUSSION ON USE OF PROGRAMS

A. TR-20 is primarily a hydrologic program; as such, it is incapable of performing hydraulic calculations. Discharge functions of reaches and structures must be previously computed and listed as tabular data for use by the program. For this reason, these functions must be single-valued, i.e., a given elevation in a cross section or reservoir results in a given discharge.

Each of the three basins was further subdivided into numerous small watersheds of one square mile or less. Hydrographs were developed for each of these sub-watersheds and combined (routed) with hydrographs from the downstream segments and so on, all the way to the mouth of the stream.

In this manner, the peak flow (cubic feet per second: CFS) at each point along the watercourse could be compared with channel capacity at that point. (In reality, there is no unique flow for a given headwater elevation, since flow is dependent upon tailwater as well. This phase of the problem is handled by the WSP-2 program.)

Hydrographs were calculated in this manner for "storms" of 2, 5, 10, 25, and 100-year recurrence intervals. (A "storm" is defined as the uniform rainfall amount over the entire basin area with an intensity and duration that has been statistically determined as the expected quantity for the frequency specified.)[1]

B. WSP-2 computes water surface profiles for a given steady flow along subsequent reaches of the channel. Because the flows required are initially unknown, the first run is made for a range of flows to establish rating curves for the TR-20 program and subsequent runs made with flow data from the TR-20 output.

It is in these subsequent runs that care must be taken in selecting input to get a proper picture of the actual water surface.

The development of a water surface profile frequently involves using the maximum flows in each reach for the length of the channel, but this does not accurately reflect the situation in a watershed where flow varies with time. A more accurate approach, although more time-consuming, is to select specific times from the TR-20 output during which the flow is at a maximum for selected reaches, and then using the flows which exist in each reach at those times as input to the WSP-2 program.

A significant feature of the WSP-2 program is its ability to calculate acres flooded with a computed profile. This is done by calculating the water surface width at the computed hydraulic grade and multiplying it by the reach length between cross section, and subtracting the area normally occupied by the stream channel. Plate A-2 represents a cross section of a natural stream. At stream height "H_1", the stream is in its natural channel and no flooding is occurring. At stream height "H_2", flooding is occurring to the extent indicated by the "flooded area" label.

* * * * *

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[1] Technical Paper No. 40, "Rainfall Frequency Atlas of the United States," Department of Commerce, Weather Bureau (May, 1961).

Technical Letter No. 13, "Rainfall Frequencies," Illinois State Water Survey (December, 1970).

PLATE A-1

EXAMPLE OF A TYPICAL HYDROGRAPH

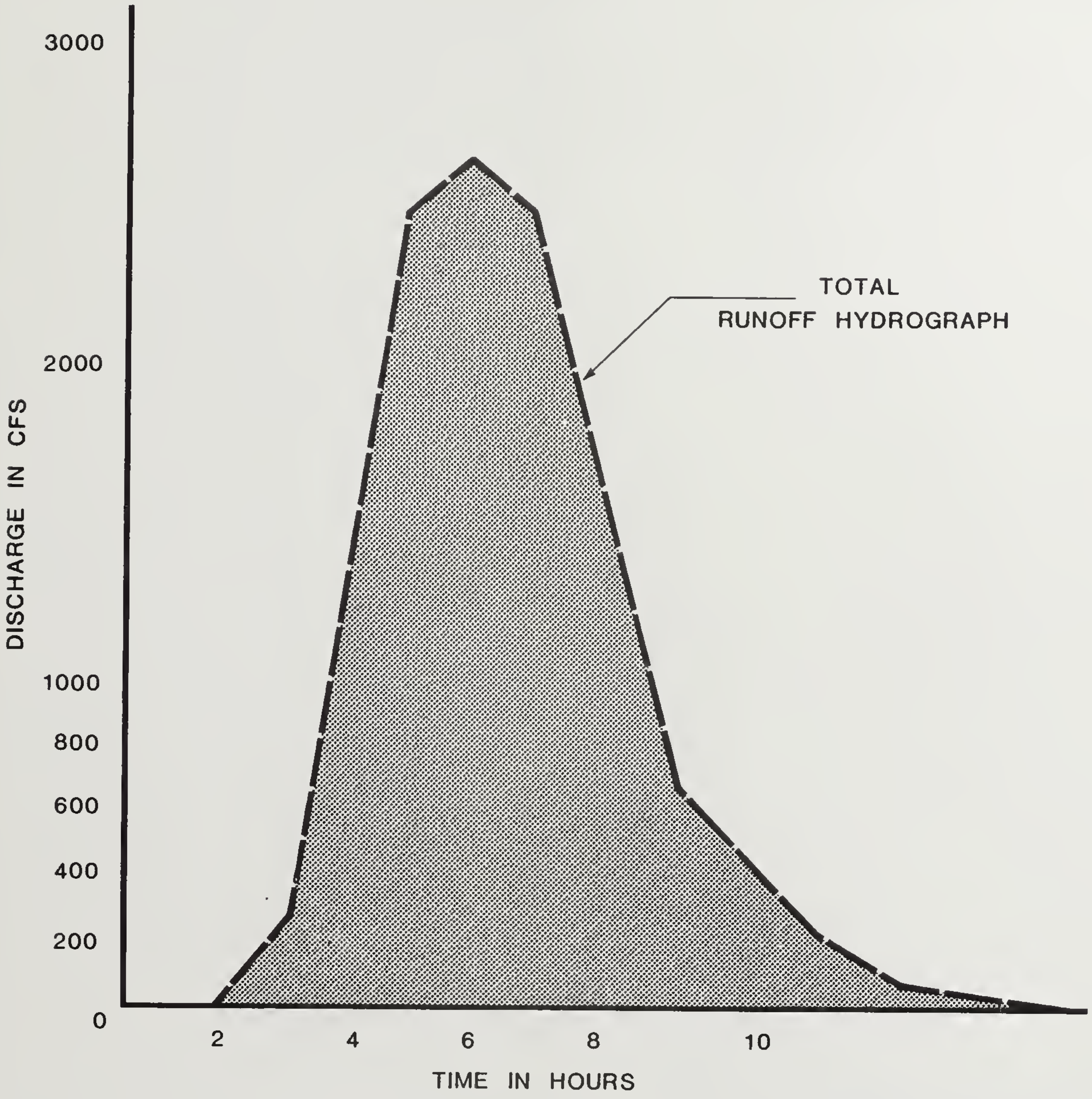
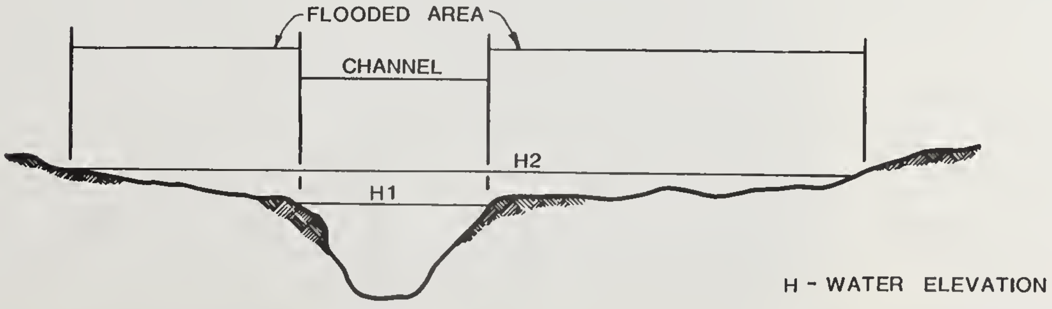


PLATE A-2

OVERBANK FLOODING

NATURAL STREAM
(VALLEY SECTION)



ALTERNATIVE SOLUTIONS

appendix b

DESCRIPTION

COMPONENTS AND COSTS

TABLE B-1.

WOOD RIVER PLANNING BASIN

LTERNATIVE SOLUTIONS

iasa Creek Planning Basin

s explained in Chapters 6 and 7, the only solution considered in the Piasa Planning
asin is totally non-structural. Therefore, no alternative comparison is incorpor-
ted in this Appendix for Piasa Creek Planning Basin.

ahokia Creek Planning Basin

situation similar to that of the Piasa Creek Basin exists for the Cahokia Creek
lanning Basin. As explained in Chapters 6 and 7, the basic plan for the Cahokia
reek Planning Basin is essentially non-structural with the only structural alter-
ative being the inclusion of those structural facilities recommended by the Corps
f Engineers for the Grassy Lake area.

ood River Planning Basin

ne alternative solutions for the major drainage system in the Wood River Planning
asin are presented in this Appendix. Various structural methods were considered
or improving drainage and flood control along the East and West Forks of the Wood
iver. Each alternative considered was in the form of a combination of functional
mponents. Each of these components has been described in Chapter 6 of this re-
rt.

ne various alternatives were evolved from six basic components. Each component is
elatively independent, in that the incorporation into an alternative is not depen-
ent upon the associated components. Hence, a large number of alternatives devel-
ped. The twenty-nine alternatives are displayed in Table B-1. The selected plan
s presented in Chapter 7 of this report incorporates the Wood River alternative
dentified as alternative solution number 7 in Table B-1.

ediment Control Alternatives

n addition to the alternatives listed in Table B-1, consideration should also be
iven to erosion and sediment control. The large amount of sediment which is eroded
nd transported through the PIWOCA area each year will continue to decrease the
apacity and ability of the watercourses to transport water if effective controls
re not implemented. There are three basic methods of control which may be used in
onjunction with any of the alternatives: (1) construction of sediment catchment
asins, (2) implementation of a sediment-removal program for major drainageways,
nd (3) initiation of good soil and water management techniques.

fter consideration of the various alternatives and the location and nature of
ediment problems in the PIWOCA area, the third measure was considered to be the
ost practicable and effective. The first measure would provide an effective means

Table B-1

ALTERNATE COMPONENTS	Component Cost in 000's of Dollars	Alternative #																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Eastern Alton Levee	165	X	X	X	X	X	X	X	X								X	X	X							X	X		
Burlington Drive Levee	77		X	X	X	X				X	X	X	X					X	X		X	X							
Mission Road Levee	34			X	X		X	X			X	X		X	X				X	X		X	X						
Forest Homes Levee	156				X	X		X	X			X	X		X	X											X	X	X
East Fork Dam	2,246																X	X	X	X	X	X	X	X	X				X
West Fork Dam	2,271																								X	X	X	X	X
TOTAL COST PER ALTERNATIVE IN THOUSANDS		165	242	276	432	398	199	355	321	77	111	267	233	34	190	156	2,411	2,488	2,522	2,445	2,333	2,357	2,280	2,246	4,517	2,436	2,592	2,427	4,673
AVERAGE ANNUAL COST IN THOUSANDS		10	15	17	27	25	12	22	20	5	7	17	15	2	12	10	148	153	155	150	143	145	140	138	278	150	160	150	288

for preventing sediment accumulation but initial and annual costs would be high. The second measure offers an excellent solution but requires an agency or agencies with legal and fiscal capability to implement a sediment-removal program throughout the PIWOA area. From both a practical and economical viewpoint, the third measure offers the best solution at the present time. A land treatment and management program could be implemented throughout the PIWOCA area by existing governmental units. The various erosion control measures which could be adopted by county and municipal governments to minimize erosion at construction sites as well as measures available to agriculturalists to control soil loss are listed in Appendix I of this report.

WOOD RIVER-EAST ALTON DRAINAGE PLAN

appendix c

DESCRIPTION
OF
DRAINAGE PLAN

PREPARED BY :
STATE OF ILLINOIS DIVISION
OF
WATER RESOURCES

PLATE C-1
PLAN OF IMPROVEMENTS

OOD RIVER - EAST ALTON DRAINAGE PLAN
TATE OF ILLINOIS, DIVISION OF WATER RESOURCES

roject Area

he proposed project is designed to reduce flood damages in 1) Lincoln Addition and astwood Subdivision in Wood River, 2) East Alton, and 3) Glendale Gardens in Wood iver Township. The project is a combination of four separate projects required to lleviate the flooding in these problem areas which are located in the bottomland rea between the base of the bluffs skirting the American Bottoms and Illinois Route 43 (see Plate C-1).

he project drainage area is broken down into four areas, A, B, C and E, as shown n Plate C-1. The watershed area of each is .48, .46, 1.82, and .61 square miles, espectively. Runoff from the steep areas within these areas enters the flat ottomland area which does not have an adequate system for delivering the water to suitable outlet.

escription of Plan

ollowing is a description of the plan, as shown on Plate C-1, for each of the three lood problem areas within the project drainage area.

he plan for Area A in East Alton calls for a channel improvement on East Alton itch from just below Main Street up to Douglas Street and culvert improvements at ain Street, Washington Avenue, Fifth Street and Wood River Avenue. Storm water ill be removed from the area more rapidly as a result of the improvement. The outet for this ditch is an existing gravity drain beneath the levee protecting the rea from the Wood River (channel). During periods of blocked drainage, the akeside Pump Station comes into operation. The plan calls for an additional pumpng station having twice the capacity of the existing pump station to help alleviate he problems in this area.

he proposed plan to reduce flooding problems in the Lincoln Addition and Eastwood reas of Wood River consists of an enlarged Sixth Street Detention Area which will tore runoff from Areas B and C. Storm water will reach the detention area via ew or improved collection ditches from the northwest and southeast. The detention rea will be drained by a pump station which will discharge through a buried presure discharge line in a generally northwesterly direction through Lincoln Addition, astwood Subdivision and through East Alton, parallel and adjacent to the East Alton itch. The line will extend over the Wood River levee and discharge into the Wood iver channel.

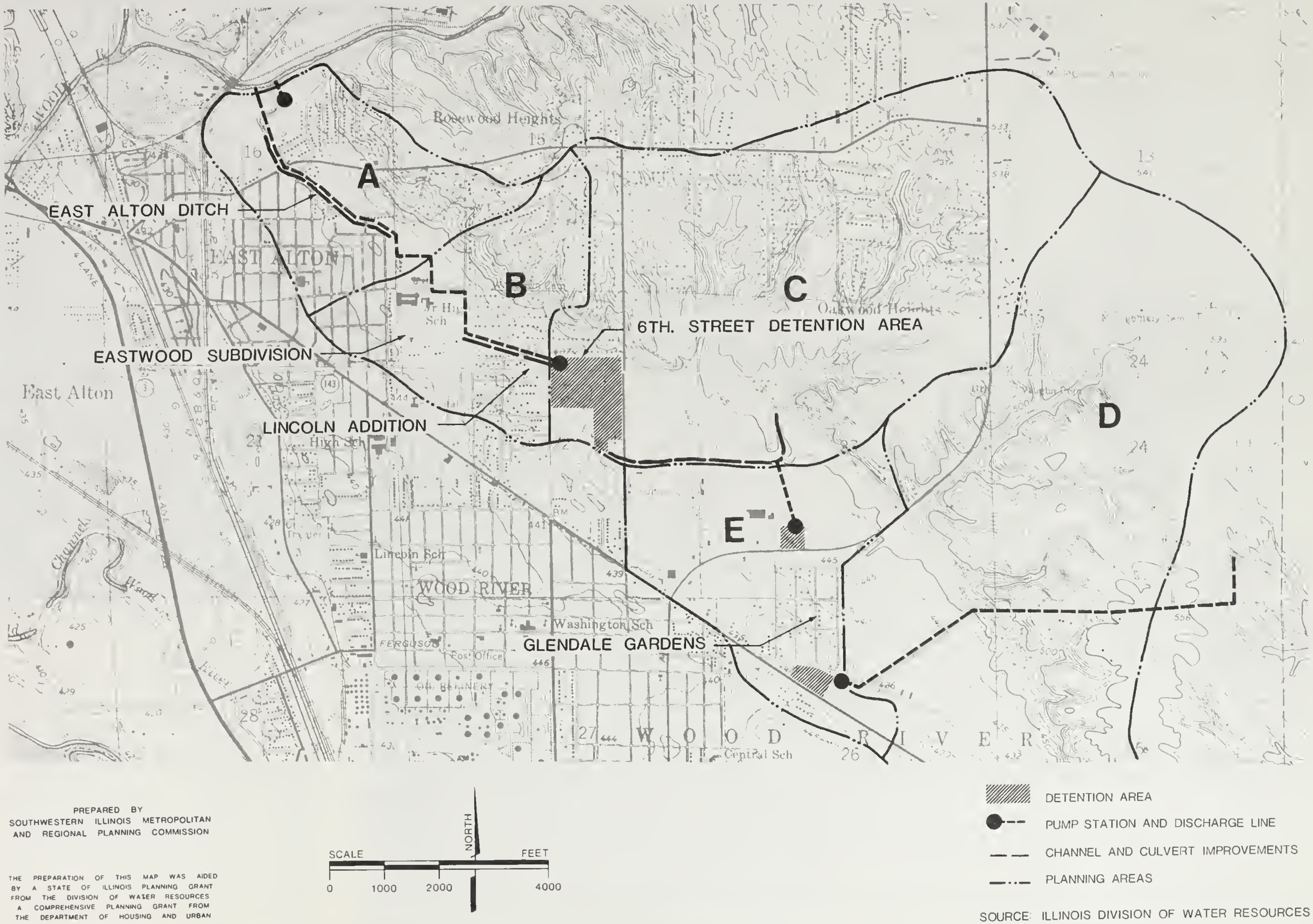
he proposed plan for the Glendale Gardens Subdivision in Area E calls for two deention areas and two pump stations. One is to be located just north of Route 111 n the north side of the subdivision. This would intercept water before it could nter the subdivision area. It would be pumped through a discharge line to the north and would outlet into the collector ditch serving Area C. The second detention area would be located south of the subdivision and would be emptied by a pump discharging through an abandoned water line which extends up to the lake in Belk Park.

The overall plan has a total first cost of approximately $4,500,000.

PLATE C-1

RECOMMENDED PLAN OF IMPROVEMENT

WOOD RIVER – EAST ALTON AREA



SOURCE: ILLINOIS DIVISION OF WATER RESOURCES

PREPARED BY
SOUTHWESTERN ILLINOIS METROPOLITAN
AND REGIONAL PLANNING COMMISSION

THE PREPARATION OF THIS MAP WAS AIDED BY A STATE OF ILLINOIS PLANNING GRANT FROM THE DIVISION OF WATER RESOURCES A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

LEGAL AND ADMINISTRATIVE FACTORS

appendix d

AGENCY JURISDICTIONS

ILLINOIS DRAINAGE LAW

EGAL AND ADMINISTRATIVE FACTORS

ost agencies needed for funding and financing of planning, design, construction,
nd operation and maintenance of the recommended drainage management and flood con-
rol measures exist on the federal, state, county, and municipal level. Because of
he many and varied agencies in existence, it is important to identify those agen-
ies having legal authority and financial capability to most effectively implement
he selected plan. For convenience, the agencies are discussed by level of govern-
ent--federal, state and local.

n addition, there is a multitude of local agencies operating with varying degrees
f responsibility and authority and, in many instances, with an overlapping of
esponsibility for drainage and flood control measures; and each of these agencies
s governed to some extent by the laws and policies of the State of Illinois. The
ollowing appendix, therefore, also includes a summary of those state statutes
hich define public policy concerning drainage and flood control.

ederal Agencies

gencies of the federal government generally have no initial jurisdictional respon-
ibility for local drainage programs or problems. However, upon request of local
r state agencies, federal agencies may provide financial support for planning and
onstruction of drainage and flood control works which benefit the public at large.

rograms of the federal government which provide grants, loans, guarantees, techni-
al assistance, and other services related to drainage problems, as well as direct
lanning, development, and operation of drainage systems and structures are dis-
ussed below.

ajor federal agencies involved in surface drainage and flood control within the
lanning Basin include the U.S. Army Corps of Engineers, the Department of Agri-
ulture, and the Department of Housing and Urban Development. Programs of these
ajor federal agencies concerned with flood control and related surface drainage
roblems are summarized in the following paragraphs.

.S. Army Corps of Engineers - The U.S. Army Corps of Engineers has been assigned
he major responsibility for nationwide flood control since 1936. Through a long
eries of Congressional Rivers and Harbor and Flood Control Acts, since that time,
orps responsibility has been expanded to include solving various phases of overall
ater resource problems. In all its studies, the Corps works closely with all
ther federal agencies and with state and local authorities who have an interest in
he planning, construction, and operation of water resource improvements. In the
lanning Basin, the Corps is currently active in a flood control and interior
rainage management project and in the preparation of flood plain information re-
orts.

he Corps does not initiate civil works projects or studies. Federal flood control
rojects are initiated by local interests, authorized by Congress, and planned and

constructed by the Corps. When a need exists for flood protection, local interests can petition their representative in Congress. A Congressional resolution or an Act of Congress may then authorize the Corps to investigate the problems and submit a report.

Since 1960, the Corps has been authorized to provide flood plain information reports. These reports aid local governments in the regulation of flood plains to avoid or minimize future flood damages. The Corps identifies specific areas subject to periodic flooding of various magnitudes and frequencies, disseminates this information to interested parties and provides engineering advice for use in planning to reduce flood damages. A flood plain information study is initiated when a state or other responsible agency requests the study and agrees to disseminate the information contained in the final report.

Department of Agriculture - The Department of Agriculture, through the Soil Conservation Service, administers the Watershed Protection and Flood Prevention Act, which provides for a partnership among the Federal Government, state governments, local communities, and individuals to deal with local water resource problems. The purpose of the Act is to carry out works of improvement pertaining to soil and water conservation and flood prevention, and agricultural water management including irrigation and drainage.

Although the Soil Conservation Service is not presently involved in major flood control projects within the Planning Basin, it is active in related programs. A detailed soils survey has been completed for St. Clair County. The Service provides research data and advice to the Soil and Water Conservation Districts and other agencies involved in storm drainage planning, and erosion and sediment control.

Department of Housing and Urban Development - The Community Development Administration of the Department of Housing and Urban Development (HUD) is authorized by Section 701 of the 2 August 1954 Housing Act to make planning grants to municipalities and combinations thereof with a population less than 50,000. These grants are for planning assistance which includes surveys, land use studies, technical services, and other planning work, but excludes plans for specific public work.

Through the Housing and Community Development Act of 1974, the Department also provides assistance (by revenue-sharing) to communities for the purpose of encouraging community development activities which are consistent with comprehensive local and areawide development planning. Eligible community development activitie include those directed toward:

- the elimination of slums and blight;
- the elimination of conditions which are detrimental to health, safety and public welfare;
- the conservation and expansion of the Nation's housing stock;

- the expansion and improvement of the quantity and quality of community services;
- a more rational utilization of land and other natural resources;
- the reduction of the isolation of income groups within communities;
- the restoration and preservation of properties of special value for historic, architectural or esthetic reasons.

ie Federal Insurance Administration (FIA), another HUD agency, administers the itional Flood Insurance Program, which insures all residences; apartment buildngs; business structures; agricultural, religious, and nonprofit buildings; and nose owned by state or local government agencies. The flood insurance program is two main objectives: (1) to provide financial assistance to victims of flood isasters in order to rehabilitate their property, and (2) to help prevent the iture unwise use of land so that annual flood damage will not continue.

tate Agencies

ie Illinois General Assembly, through its enactment of legislation, has authorized everal state agencies to engage in numerous water management activities. Those gencies which are engaged in activities of concern to this study are described riefly in this section.

ivision of Water Resources - The Division of Water Resources of the Illinois epartment of Transportation has responsibility for the adequate development of the ater resources of the state, administration of the regulatory provisions pertainng to the rivers, lakes and streams of the state, and exercise of the trusteeship ver the public waters of the lands of the state. The Division may investigate ncroachments, obstructions or pollution in public water by private or other intersts and collect information and data pertaining to navigability, flood control, eclamation and drainage. It also prepares plans and specifications, and superises construction of projects for flood control, including earthen dams, retention ams, and various types of water control structures.

n addition, an amendment to the Rivers and Lakes Act, passed by the General Assemly in 1971 authorizes the Illinois Department of Transportation to define flood lains in Illinois, publish appropriate maps and data, cooperate with local units f government, and institute a permit procedure for regulating construction on the lood plain.

ivision of Soil and Water Conservation - The Division of Soil and Water Conseration of the Illinois Department of Agriculture is responsible for investigating ll applications for watershed assistance. It is responsible for providing information and advice on watershed development projects, dispensing state funds appropriated for local districts and disseminating information on current related surveys and preliminary investigations on approved watersheds. Further, it provides for the employment of engineers in cooperation with the Soil Conservation Service of the United States Department of Agriculture in the preparation of watershed plans and designs for works of improvement.

Local Agencies

Local agencies are created by the states, and their powers are generally enumerate in their charters and the legislative acts creating them. Serious jurisdictional problems arise from the fact that these local agencies have sprung forth in numbers too great, with purposes too limited, and with powers overlapping those of other local agencies in the same region. Municipalities, sanitary districts, drai-age districts, and soil conservation districts--to name a few--might all be found trying to function in the same section of a state. None alone can do an adequate job of overall local water regulation, and together they often operate at cross-purposes, preventing effective use of even the limited powers they have. Acting i concert, with a spirit of cooperation, these jurisdicational problems could be mi imized. But it is perhaps unrealistic to place too great a premium on cooperatio Some states, including the State of Illinois, have taken measures to ameliorate these jurisdictional problems by passing legislation which enables the establishment of broad-powered water conservancy districts to provide centralized overall guidance in the management of water resources at the local level.

In addition to jurisdictional problems, local level agencies also suffer from an inability to finance themselves. It is generally the case that the legislation creating these local agencies limits the amount of funds they can raise to a small percentage of the value of property within their boundaries. Measures must be taken to raise these percentage limits. Certainly, if local government of water resources is to achieve viability, action will have to be taken to meet the jurisdictional and financial problems which plague local agencies.

The Illinois General Assembly, through enabling legislation, delegates powers to the political subdivision of the state. Counties and municipalities have been authorized to engage in varied water management functions. In addition, the General Assembly has sanctioned the creation of numerous special purpose district with powers to furnish various water services. The powers and responsibilities concerning storm drainage and flood control delegated to these local agencies are summarized below.

Municipalities - The Illinois General Assembly, through enabling legislation, has delegated specific powers and responsibilities to the political subdivisions of the state. Through this process, municipalities are authorized to engage in varied water management functions.

The Illinois Revised Statutes have given municipalities the jurisdiction over all waters within and bordering upon their corporate limits. Included in their ithority is the power and responsibility to provide for a supply of water for fire rotection and for the use of inhabitants in various ways, to contract with the iited States regarding flood control projects, and to provide drainage and protecion from overflow. The specific municipal powers and responsibilities relating to torm drainage and flood control are listed in Table D-1.

ounties - The Illinois Revised Statutes has established powers and responsibilties for counties as well as municipalities, as related to surface drainage probems. These guidelines allow the counties to supervise, regulate and control the low within their boundaries of any stream or watercourse over and through any dams nd other obstructions, so long as they do not curtail any vested water power ights or other rights. In addition, counties have the power to prescribe reasonble requirements with respect to water supply, sewage disposal and street drainage. ne specific powers and responsibilities of counties which relate to surface drainge and flood control are listed in Table D-2.

pecial Districts - The Illinois General Assembly, in addition to delegating powers the political subdivisions of the state, has sanctioned the creation of a host f special districts with powers to furnish various water services. The powers and esponsibilities concerning storm drainage and flood control delegated to these istricts are briefly discussed below and are listed in Table D-3.

oil and Water Conservation Districts conduct a variety of functions relating to oil and water conservation and the control and prevention of soil erosion of floodater and sediment damages. These districts are involved in various projects, inluding surface and internal drainage, channel improvement and maintenance, impoundent and regulation of stream flow, and land treatment to retard water movement.

istricts are formed upon the approval of a petition submitted to the State Departent of Agriculture. The governing body of a district consists of five directors lected by the members of the district. Within the Planning Basin, two districts ave been formed, one for each of the two counties.

oil and Water Conservation Sub-districts may be organized to develop and execute lans, programs and projects relating to any phase of flood prevention. Their esponsibility also extends to the operation and maintenance of their works of imrovement. Formation of sub-districts are initiated by petition to district irectors from a majority of the landowners owning a majority of the land.

rainage Districts may be formed to construct, maintain, or repair drains on levees, r to engage in other drainage or levee work for agricultural, sanitary, or mining urposes. Activities of the district are coordinated and directed by a group of ommissioners, whose powers and duties include:

- to adopt a plan of drainage;

Table D-1
MUNICIPAL POWERS AND RESPONSIBILITIES
RELATED TO SURFACE DRAINAGE

Chapter & Section	Power or Responsibility	Limitations	Miscellaneous Information
Ch. 24 S. 1-2-1	Pass all ordinances necessary to exercise powers.		
Ch. 24 S. 1-2-1.1	Make ordinance violations punishable misdemeanors.	Punishment not to exceed six months incarceration.	
Ch. 24 S. 1-2-4	1. Ordinances shall be published within ten days after passage. 2. Shall be printed in pamphlet or booklet form.	Applies only to appropriations ordinances or ordinances imposing a fine, penalty, imprisonment or forfeiture.	
Ch. 24 S. 1-3-2a	Adopt by reference county subdivision code.	1. File three copies with city clerk. 2. File copies at least 15 days prior to adoption.	
Ch. 24 S. 9-5-1 et seq.	Reimburse subdivider for portion of municipally required facilities, when such facilities benefit corporate areas outside subdivision (by contract).	Contracts shall be filed with county recorder of deeds.	Does not apply to municipality which is a home rule unit.
Ch. 24 S. 11-12-4	Creation of a municipal planning commission for general planning or specific purposes.		May accept funds, grants, or services from Federal Government, State of Illinois, or private or corporate sources
Ch. 24 S. 11-12-5	Planning Commission general powers: 1. Develop comprehensive plan for municipality and area within 1½ miles of municipality; 2. Recommend changes in comprehensive plan; 3. Prepare and recommend specific purpose plans; 4. Assist municipal officers in directing plan implementation.		
Ch. 24 S. 11-12-6 11-12-7	May adopt comprehensive plan and official municipal map.	1. Shall be advisory only and not construed as regulatory. 2. May adopt plan only after and within 90 days of public hearing of plan.	
Ch. 24 S. 11-12-8 11-12-9	Determine whether a proposed plat of subdivision is in compliance with official comprehensive plan and map.	When proposed plat lies within or within 1½ miles of corporate limits of two or more municipalities, authorities shall agree upon jurisdictional boundary line.	
Ch. 24 S. 11-13-1	1. Regulate height and bulk of building. 2. Establish setback lines along any trafficway, storm or floodway, runoff channel or basin. 3. Regulate land use intensity and area of open space. 4. Regulate, classify and restrict location of specific-use buildings. 5. Divide municipality into zones or districts to facilitate carrying out regulations. 6. Fix building and structure standards. 7. Prohibit building use incompatible with designated district. 8. Prevent alterations to structures in such a way as to avoid restrictions.		
Ch. 24 S. 11-13-2	Provide for a zoning commission with duty to recommend district boundaries and appropriate regulations.	Recommendations shall be presented at public hearing, after which and within 30 days of final report shall be made to corporate authorities.	
Ch. 24 S. 11-13-3 11-13-6	Provide for a zoning board of appeals.	Only after conducting a hearing may board grant variance.	

Table D-1 (continued)

hapter & ection	Power or Responsibility	Limitations	Miscellaneous Information
h. 24 . 11-13-10	Corporate authorities may adopt by ordinance variations proposed by board of appeals or refer it back to board of appeals for further consideration.		
Ch. 24 S. 11-13-14	Zoning regulations and district boundaries may be amended from time to time by ordinance.	Amendment ordinances may be adopted only after a hearing before committee designated by corporate authorities.	
Ch. 24 S. 11-13-17	Acquisition by purchase, condemnation or otherwise any structures which do not conform to standards fixed by corporate authorities.		
Ch. 24 S. 11-13-19	Publish map clearly showing current zoning, divisions, regulations and classifications.	Required to publish once each year, prior to March 31st.	
Ch. 24 S. 11-14-1	Establish by ordinance regulations and limits of setback lines along any trafficway, storm or floodway, or runoff channel.		
Ch. 24 S. 11-14-2	Officers shall be designated for enforcement of setback line ordinances.		
Ch. 24 S. 11-14-3	Setback lines regulations may be amended from time to time as necessary.	Amendments only after public hearing and two-thirds vote of city council.	
Ch. 24 S. 11-15-1	Provide that any map, plat, subdivision, block, or lot be submitted for approval prior to recording.		
Ch. 24 S. 11-20-4	Provide for cleansing and purification of waters, and watercourses, and, if deemed necessary, drain and fill ponds on private property.		
Ch. 24 S. 11-30-2	Prescribe rules and regulations for the construction and alteration of buildings and structures to avoid flood hazards.		
Ch. 24 S. 11-30-8	Prescribe rules and regulations for grading and draining of lots, construction of paved motor vehicle driveways and parking areas, grading of terraces, construction of retaining walls and for preserving drainage channels.		
Ch. 24 S. 11-48.2-2	1. Oevelopment rights in a landmark site are the rights granted under local law. 2. Impose preservation restrictions. 3. All or part of development rights in a landmark site may be transferred to other property.	Compensation for restrictions must be paid if a taking; otherwise must be reasonable exercise of police power.	Section does not apply to home rule units.
Ch. 24 S. 11-87-1	By ordinance may provide for laying out, establishing, opening, altering, grading or otherwise improving streets, alleys, and sidewalks, and by same ordinance may change or relocate the channel, course, or bed of any watercourse.	Watercourse shall be construed to include all banks, beds and waters connected to or adjacent to the watercourse or stream.	
Ch. 24 S. 11-87-3	May fill or alter any non-navigable watercourse terminating within corporate limits for the purpose of improving any street, avenue or alley.		Property may be acquired for this purpose by an ordinance providing for the exercise of power of eminent domain.
Ch. 24 S. 11-104-1	May deepen, widen, dock, cover, wall or alter channels of watercourses.		

Table D-1 (continued)

Chapter & Section	Power or Responsibility	Limitations	Miscellaneous Information
Ch. 24 S. 11-104-1	May deepen, widen, dock, cover, wall or alter channels of watercourses.		
Ch. 24 S. 11-105-1	Corporate authorities may accept or receive through gift, grant, devise, dedication, or otherwise, parks, areas enclosing floodways, floodwater runoff channels and detention ponds, and other grounds and easements located within corporate limits.		May also accept lands within 1½ miles of corporate limits.
Ch. 24 S. 11-110-1 11-110-3	Establish, construct, and maintain drains, ditches, levees, dykes, pumping works, and acquire lands and machinery.		If it is deemed necessary to extend drainage structure beyond corporate limits, the corporate authorities may exercise the power of eminent domain to acquire right-of-way; may finance by special assessment tax in area of benefited property or general taxation
Ch. 24 S. 11-111-1 et seq.	1. May divide municipality into drainage improvement districts. 2. Fix grade standards to cause drainage to stream causing overflow problem. 3. Require filling of any lands within corporate limits to prevent standing water.	Shall have engineer conduct accurate survey and make plats, profiles, and estimates of work to be done.	May issue bonds after determination of improvement costs and collect special tax or assessment to pay off bonds.
Ch. 24 S. 1-112-1 1-112-2	Tax for levee purposes.	Taxes must be approved by majority vote. Maximum rate shall be .1666%. Maximum duration shall be seven years.	
Ch. 24 S. 11-113-1	Remove surface water and sewage due to flood condition, with annual tax levy.	Municipalities less than 500,000. Tax shall not exceed .15%	Tax must be approved by a majority of those voting.
Ch. 24 S. 11-114-1 11-114-2	Provision, by ordinance, of levee improvement commission.	Municipalities less than 500,000. Municipality bounded by or intersected by navigable waters.	Commission has full control and supervision of all improvements, docks, levees, industrial development and facilities on the waterfront, and land approximate to the waterfront.
Ch. 24 S. 11-115-1	Contract with State to take over State constructed flood protection structures.		
Ch. 24 S. 11-115.1-1	Contract with the U.S. with reference to U.S.-constructed flood control project to: 1. Provide all lands, easements and rights-of-way; 2. Contribute part of first cost; 3. Grant U.S. immunity from liability for damages resulting from project; 4. Maintain and operate constructed project; 5. Establish and enforce flood channel limits, 6. Prevent dumping and filling within flood channel limits; 7. Regulate construction of structures crossing waterway; 8. Restrict further residential development in protected area.		Municipality may elect to make additional contribution for a higher degree of protection to allow for further residential development.
Ch. 85 S. 1711	Adoption of provisions of "An Act for Prevention of Flood Damage, October 1, 1973."	Only municipalities having power to issue building permits and otherwise control construction.	This Act does not apply to a municipality which is a home rule unit.
Ch. 85 S. 1712 1713	Require building permit applications to include statement that construction will include facilities for proper runoff or retention of rain or snowmelts.	Municipality shall consider factors such as soil permeability and adequacy of existing waterways. Ordinance adoption only after publishing three times at weekly intervals and public hearing has been held.	
Ch. 85 S. 1714	Ordinances under Section 1712 may be amended from time to time.	Same limitations as for ordinance under Section 1712.	
Ch. 85 S. 2103 et seq.	Receive and expend funds from Department of Conservation grant for acquisition of open space land, easements, and other property interests.	Application for grant must include legal description of land, current appraisal at fair market value, project cost, and narrative description of project. To be filed immediately preceding April 1st.	First priority given to projects which benefit residents directly; second priority to projects in flood plain areas.
Ch. 85 S. 1002 et seq.	Adopt as criteria for construction any code or part of code established by nationally recognized trade or service association. By ordinance.	Ordinance shall be subject to all publication requirements, as if no code was incorporated. State standards must be adopted if available.	Adoption of code penalty clause by reference is prohibited.

Source: Illinois Revised Statutes, 1973.

Table D-2
COUNTY POWERS AND RESPONSIBILITIES RELATED TO SURFACE DRAINAGE

pter & tion	Power or Responsibility	Limitations	Miscellaneous Information
34 414	Regulate, by resolution, the location, width, and course of streets, highways, and storm or floodwater runoff channels and basins.		May include reasonable requirements with respect to water supply and sewage collection as established by EPA, and include surfacing and drainage requirements as specified by Department of Highways.
34 418.1	Accept through gift, grants, devise, dedication in plats of subdivision, or otherwise, parks, areas enclosing flood plains, floodwater runoff channels and detention ponds or basins and other public lands of the county not in incorporated areas.		
34 422	Prescribe, by resolution, reasonable regulations governing construction and alteration of all buildings, structures and mobile home parks, and govern the maintenance thereof to prevent fires, explosions, flooding, and the spread of infectious disease.		
. 34 430	Cause the removal of driftwood and other debris from natural and other watercourses.	Must give written notice to property owner at least ten days prior to entering private property.	
. 34 652 t seq.	Adopt, by reference, any code or rules and regulations prepared and published by various technical trade or service associations.	At least three copies must be filed with the county clerk at least fifteen days prior to adoption. Must abide by all ordinance publication requirements.	Amendment may be made by reference provided amended copies are on file with county clerk for public inspection and use.
. 34 3001 3002	May define all or part of the county as a region and establish a regional planning commission for making a regional plan.	Regional planning commission shall be authorized to: - employ assistance as deemed necessary; - receive and expend funds, grants, and services of departments of federal and state governments; - contract with respect to any funds from whatever source derived; - provide information and reports necessary to acquire financial aid.	County board may appropriate to the commission any funds under its control and not otherwise appropriated.
. 34 3003	Counties may jointly define a region and create a joint regional commission.		
. 34 3004	Appointed members of the regional planning commission shall receive no pay.	Plans made by commission are to be advisory only.	
. 34 3101 3102 3104 3105	Any county may adopt "The Water Supply, Drainage, and Flood Control Act, July 22, 1959" by resolution of county board, by at least two-thirds of the elected members.	Powers of this act shall only be enacted where similar services are not provided by other governmental units.	May establish a Department of Public Works with authority to exercise supervision over projects authorized under this Act. May levy tax not to exceed .02% of assessed valuation.
n. 34 . 3106	Authorized and empowered to clean out, straighten, widen, alter, deepen, or change the course of any ditch, drain, sewer, river, watercourse, or natural stream in the county. May construct and maintain main and lateral ditches, sewers, canals, levees, dikes, dams, reservoirs, holding basins, floodways and pumping stations.		
h. 34 . 3107	May supervise, regulate, and control the flow within the boundaries of the county of any watercourse.		
h. 34 . 3110	County board may construct dams and reservoirs, purification works, and pumping stations, and acquire land for such purposes.		

Table D-2 (continued)

Chapter & Section	Power or Responsibility	Limitations	Miscellaneous Information
Ch. 34 S. 3112	County board may construct, maintain, alter, and extend its sewers, pipelines, channels, and ditches along, under, upon and across any highways, streets, or public ground.	Extent and location of land to be used shall be approved by governor.	
Ch. 34 S. 3114	Before commencing any work under this Act, approval must be given by the Department of Public Works and the Environmental Protection Agency of the State of Illinois.		County may issue and sell bonds, payable solely from income derived from operation of the system.
Ch. 34 S. 3115	County may enter into contracts or agreements with proper agencies of the U.S. Government, municipalities of Illinois, political subdivisions and persons for the formulation of plans and for construction of improvements for the control of destructive floods and for conservation and regulation of waterways and water resources.		
Ch. 34 S. 3151 3152 3153 3154	County board shall have authority to regulate and restrict the location and use of buildings, structures and land for trade, industry, residence and other uses. May regulate intensity of use, establish setback lines, and divide county into districts according to use of land and buildings.	Counties desiring to exercise the powers of the county zoning act shall provide for a county zoning commission of not less than three nor more than nine members.	Commission shall prepare tentative zoning ordinance for all parts of county not within zoned areas zoned by a municipality. After adoption, ordinance shall be enforced by officer designated by commission.
Ch. 34 S. 3201 3202 3203	County board may establish, regulate and limit the building or setback lines on or along any roads, streets, trafficways, or drives outside corporate areas.		Setback regulations shall be enforced by officer designated by resolution. Amendments may be made after hearing before a committee designated by county board.

Source: Illinois Revised Statutes, 1973.

Table D-3
SPECIAL DISTRICTS POWERS AND RESPONSIBILITIES
RELATED TO SURFACE DRAINAGE

Type of District	Formation	Powers and Responsibilities	Financial Capabilities
Soil & Water Conservation Districts - Ch. 5 Sections 106-131	1. Petition by twenty-five landowners owning 10 percent of proposed district to Illinois Department of Agriculture. 2. Public hearing. 3. Decision made by Illinois Department of Agriculture. 4. Department may require referendum.	Authorized to cooperate and effectuate agreements with individuals or agencies of government to plan, construct, operate and maintain programs and projects relating to conservation of natural resources. Power of eminent domain. May establish land use regulations after public hearing and referendum.	No revenue raising authority. May receive certain funds from Division of Soil and Water Conservation of the Department of Agriculture, and contributions from counties.
Soil & Water Conservation Sub-districts - Ch. 6 S. 131b	1. Petition by a majority of landowners owning a majority of the land to district directors. 2. Public hearing. 3. Referendum requiring a majority of votes cast.	Power to develop and execute plans, programs and projects relating to any phase of flood prevention. Operate and maintain works of improvement.	Power to levy and collect annual tax not to exceed 0.125% of total assessed valuation of property of the sub-district. Board of directors may finance works by special assessment.
Drainage Districts - Ch. 42	1. Petition of a majority of voters owning one-third of the land OR at least more than one-third of the people owning a major portion of the land. 2. Public hearing held by the courts. 3. Court makes decision and orders appointment of temporary commissioners.	Construct, maintain, and repair drains and levees.	Must petition court in which district is organized to levy tax or increase assessment. Negotiate and obtain loans from State or Federal Governments. May accept grant funds from State or Federal agencies.
River Conservancy Districts - Ch. 42 S. 383 et seq.	1. Petition by 1% of voters of proposed district to circuit court. 2. Public hearing. 3. Public votes. Need majority of votes cast.	Authorized to alter any watercourse or related structure in order to effect protection, reclamation or irrigation of property in the district. Authorized to construct, maintain, and operate any drainage related facilities in the district in order to effect protection, reclamation or irrigation of property. Supervise, regulate, and control flow of waters in any watercourse over or through any dam or like structure. To acquire by eminent domain, donation, purchase or condemnation, and construct, own, lease, and sell any property real or personal.	May borrow money and issue general obligation bonds after approval of district voters. Indebtedness not to exceed 5% of total assessed valuation of property. Special assessment may be levied for improvements benefiting specific property. May levy taxes on property for corporate purposes not to exceed .083%. May increase tax to .75% if population is less than 25,000 or to .375% if population is greater than 25,000 by election by voters.
Forest Preserve District - Ch. 57½ Sections 1-15	1. Petition by 500 voters of proposed district. 2. Public hearing. 3. Circuit judge orders recording of boundaries. 4. Establishment of district requires majority of votes cast.	May acquire lands along watercourses, lakes, ponds, and planned impoundments or lands required to store floodwater, control other drainage, and to preserve ground water. May acquire land by purchase, gift, grant, devise, or condemnation.	Board may borrow money upon the faith and credit of the district and issue bonds therefor. If district population is less than 1,000,000, total debt may not exceed 2% of assessed valuation. If bonds are for the purposes other than land acquisition, it must be considered by the voters. Bonds for land purchase of up to 55,000 acres require no election. Annual tax levy may not exceed .025% of assessed valuation (these are exclusive of taxes required to pay principal and interest on bonds).
Mosquito Abatement Districts - Ch. 111½ S. 27 et seq.	1. Petition by 5% of legal voters, to the circuit court. 2. Public hearing. 3. Election requiring majority of votes cast.	Treat stagnant pools. Build and maintain levees, cuts, canals, and channels. May use eminent domain.	May levy general tax on property not to exceed .025% annually.
Surface Water Protection District - Ch. 42 S. 448 et seq.	1. Petition by majority of landowners to circuit court. 2. Public hearing. 3. Approval of majority of voters. or 4. Petition by ALL landowners of proposed district.	Provide facilities for the prevention and control of surface water damage. Prescribe all necessary regulations, acquire, establish, maintain, and operate ditches, channels, pumping stations, basins, dams, levees, and other structures.	

Source: Illinois Revised Statutes, 1973.

- to obtain lands and rights-of-way by eminent domain, if necessary;
- to let contracts for the surveying, construction, and maintenance of any drain or levee;
- to widen, deepen or straighten any ditch or watercourse;
- to cause railroad companies to construct or rebuild bridges where necessary; and
- to levy assessments and issue bonds to finance its activities (drainage districts do not have corporate taxing power).

There are four drainage districts in the Planning Basin, all of which are actively involved in drainage or levee work. Additional information concerning the powers and responsibilities are shown in Table D-3.

River Conservancy Districts may be formed to alter any watercourse or related structure and to construct, maintain, and operate any drainage related facilities in the district in order to effect protection, reclamation or irrigation of property. The districts' responsibilities include the supervision regulation and control of water flows in any watercourse over or through any dam or like structure. The formation of a district is initiated by filing a petition, from 1 percent of the the voters of the proposed district, with the circuit judges of all counties involved.

Forest Preserve Districts are authorized to acquire lands along watercourses, lakes, ponds, and planned impoundments required to store floodwater, control other drainage, and to preserve ground water. Land may be acquired by purchase, gift, grant, devise, or condemnation. Formation of a district is initiated by a petition signed by 500 voters of the proposed district.

Mosquito Abatement Districts are organized to exterminate mosquitoes, flies, and other insects. Specifically, the districts are authorized to treat all stagnant pools of water and other breeding places; to build and maintain levees, cuts, canals, and channels; and to cooperate with the State Department of Public Health.

Surface-Water Protection Districts are formed to provide adequate protection from surface water for all persons and property within the district boundaries and to prescribe the necessary regulations for the prevention and control of surface water drainage. Surface-water protection districts are organized by petition to the circuit court of the county containing the major portion of the proposed district. The activities of the district are governed by a board of trustees, which has the power to:

- make ordinances for protection from water damage;
- acquire property rights by eminent domain, if necessary;
- erect and maintain structures necessary for carrying out its purposes (if proposed project will increase the flow in any stream, plans must be submitted to the state for approval); and
- issue bonds and borrow money if authorized to do so.

LLINOIS DRAINAGE LAWS AND POLICIES

rainage in Illinois has been, and still is, governed primarily by the rules of aw announced in opinions of the State's Supreme and Appellate courts. Drainage ights, however, can also be affected by state and federal legislation; federal ourt decisions; rules, orders, and regulations of state and federal agencies; laws nd ordinances of local governmental units and special-purpose districts; inter-tate compacts; and local court decisions that have not been overruled by the upreme and appellate courts. In addition, the scope of various laws is regulated nd limited by certain provisions of the state and federal constitutions.

rainage laws and policies of the State of Illinois are presented below. The dis-ussion includes a brief synopsis of pertinent statutory and judicial holdings overning the drainage of surface waters.

ivil Rule of Drainage

rainage law is concerned with the extent of the right of one person to have water low from his land without being obstructed, and the extent of the reciprocal duty f another person not to obstruct water flowing onto his land. In Illinois, drain-ge law is based on the "civil law rule" as codified and revised by the Illinois rainage Code[1] and interpreted by the courts. The civil law rule, also known as he rule of natural drainage, grants an upper landowner the right to cast surface ater onto lower land without paying compensation if the water would naturally flow here.[2] Conversely, a lower landowner must accept surface water naturally draining nto his land, and may not build embankments or other artificial devices to stop it t the property line or to throw it back onto the upper land.[3] However, the lower andowner is obliged to receive only the water flowing in a channel or natural de-ression; he need not accept unchanneled or diffused surface water. The principle nderlying the civil law rule is that, since nature ordained drainage in a certain anner, "it is but plain and natural justice that the individual ownership arising rom social laws should be held in accordance with pre-existing laws and arrange-ents of nature."[4] The civil law rule of drainage is applicable not only to agri-ultural land, but also to railroads,[5] highways,[6] municipal corporations,[7] and city ots[8] unless the city had adopted a system of artificial drainage. In resolving pecific drainage disputes, court decisions, as cited below, have added modifica-ions and exemptions to the basic civil law rule.

Early Judicial Interpretations

One of the earliest and most important modifications to the basic civil law of drainage was announced in Peck vs Herrington.[9] That court held that an upper agricultural landowner cannot construct drains or ditches to create new channels for water in a lower landowner's field, but he may construct drains on his own property if "good husbandry" requires. He is not liable to the lower landowner even if his actions cause an increase in water runoff, provided the water is drained off in a regular, well-defined channel. The good husbandry exception permits an upper landowner to drain ponds on his land, but does not allow him to drai large bodies of water onto lower land if such drainage would destroy the lower land.

An Illinois landowner may empty surface waters into a natural water course either by open ditch or by tile drains.[10] Substitution of tile for surface drainage does not amount to an abandonment by the owner of his natural drainage rights.[11] A ditch, constructed wholly on the upper landowner's property, which takes water from a ravine and by a short cut empties it into the natural course of water has been judicially approved. Such a ditch is legally accepted even though it accelerates the flow of water and carries debris which otherwise would not have been deposited on the lower land.[12]

However, an upper landowner's right to alter the surface water drainage of his lan regardless of cause or extent of increase is not unlimited. For example, he may not alter natural drainage so as to bring in water from another watershed nor may he remove natural barriers thereby letting water onto lower land which in nature would not have flowed there.[13] An upper landowner who alters the natural course of water must restore the water to its natural channel within the limits of his own land. Moreover, he may discharge water onto lower land only at the precise place where it would naturally be discharged.[14] If an upper landowner empties water onto the land in such quantities that it overflows, the natural channel othe than where it would naturally do so, he may be held liable.[15]

The gist of these decisions presently appear as Section 2-1 of the Illinois Drainage Code: "Land may be drained in the general course of natural drainage by eithe open or covered drains. When such a drain is entirely upon the land of the owner constructing the drain, he shall not be liable in damages therefor."

Prescriptive Easements

A legal right to cross or use another's land which normally would not exist may be acquired by prescriptive easement. This means that if a landowner harms another owner for a period of twenty years and during all that time the injured party fail to enforce his rights, the harmful practice itself may become a right. Similarly, a benefit which normally would be unenforceable may become a legal right if it is continuously conferred for twenty years. Applying these principles to drainage situations, Illinois courts have held that an upper landowner who has diverted water from its natural course and established an artificial channel through which water has flowed without interruption for twenty years becomes exempt from the ual duty to restore water to its original course.[16] In another case, where the per landowner had voluntarily changed the course of natural drainage so that ter ceased to flow over another's lower land for twenty years, the court decided at the lower landowner had acquired the right to have this beneficial condition ntinued.[17]

mpleton vs Huss

nd is drained in nature either laterally or by seepage of water into the soil. e cases discussed thus far have primarily concerned the manner and degree in ich a landowner may interfere with natural lateral drainage in order to improve s land for agricultural purposes. In Templeton vs Huss,[18] the defendant-bdivider substantially increased the amount and rate of surface runoff by inter-ring with natural seepage in the process of converting a parcel of farmland into residential subdivision. The defendants contended that their right to increase rface runoff onto the lower land in this manner was unlimited because the in-ease was not caused by diversion from another watershed. The court rejected this gument, and held that even if the increased runoff was merely the consequence of e installation of septic tanks, grading and paving of streets, or construction houses and basements, the defendants were liable if the runoff increase was reasonable.

mpleton also indicated that the codefendant village, which had approved and ac-pted the plats submitted by the subdividers, could be held liable for any un-asonable increase in surface runoff. The village's liability was premised on e theory that it knew or should have known that the subdivider's activities would use water to flow onto the lower land in larger-than-natural amounts.

ainage of Flat Land Generally

two parcels of land are on the same flat level, a landowner, according to the les of natural drainage, has no right to cast water on adjoining land or to dig ditch through adjoining land, even though both parcels may be rendered useless r lack of drainage. Nor does the law of natural drainage give a landowner who s natural drainage any right to go on another's land to open up a channel to ain off his lands when the drainageways have become choked or clogged or when e fall is so slight that surface waters are not drained away fast enough to low the land to be cultivated.

ctions 2-2 through 2-12 of the Illinois Drainage Code were enacted to remedy ese problems. More specifically, Sections 2-2 through 2-7 focus on those sit-ations where one landowner will be benefitted and others injured by the surface ainage alterations.

 Illinois when a landowner needs to extend drains through another's land in order obtain a proper outlet but the other landowner refuses to consent to such ex-nsion, the aggrieved landowner (plaintiff) may file a civil suit in the circuit urt of the county where his land is situated. If the plaintiff is a drainage district, proceedings must be conducted under the Eminent Domain Act.[19] The plaintiff must file a bond of not less than $100 and a plat indicating the precise location of the planned extension.

At trial the plaintiff must prove that the proposed drain is of ample capacity and will not materially damage the defendant's land. The plaintiff also must show that the proposed drain will empty into (1) a natural watercourse, (2) an artificia drain along a public highway (provided the highway authorities approve), or (3) some other outlet which he has a right to use. If it is decided that the plaintif has proven these matters, he will be allowed to extend his drains. Nevertheless, since entry on defendant's land and construction of the drain constitutes a taking the plaintiff must pay appropriate damages.[20] If a landowner to whom a court grants permission for drain extensions through other's land fails to construct the drain within two years, he is barred for five years from bringing suit for the same purpose.

A landowner who receives permission for drain construction on another's land is also allowed to enter upon that land whenever necessary to repair or maintain his drains.[21] If in the course of such repairs, he injures any crops or other property, he must pay actual damages to the owner. If he causes harm wilfully, he must pay triple damages.

Drains for Mutual Benefit

Where a drain (or levee) is constructed for the mutual benefit of several landowners, as opposed to construction for the benefit of one landowner and to the detriment or inconvenience of others, Sections 2-8 through 2-12 of the Illinois Drainage Code are applicable.[22] These sections provide that no person may connec his drainage facilities to a mutual drain unless all parties interested in the mutual drain consent.[23] The remedy for unauthorized connections is a court order compelling the persons constructing the unlawful drains to disconnect them.[24]

There appears to be a judicial controversy regarding the existence of an affirmative duty to repair and maintain a mutual drainage system.[25] Sections 2-10 and 2-12 do state that no one may obstruct or impair a mutual drainage syste for example, by digging out tile or filling in ditches, unless all interested parties consent.[26] Furthermore, Section 2-11 grants to the owner of any land serviced by a mutual drain the right to enter on land where the drain is situated to make repairs at his own expense. The repairer is not liable for damages unless he performs the work negligently.

* * * * *

[1] *Illinois Revised Statutes,* Chapter 42, effective January 1, 1956.

[2] *Gillhan vs Madison County R.R. Co.,* 49 Ill. 484 (1869); *Graham vs Keene,* 143 Ill 425, 32 N.E. 180 (1892); *Wills vs Babb,* 222 Ill. 95, 78 N.E. 42 (1906); *Mello vs Lepisto,* 77 Ill. App. 2d 399, 222 N.E. 2d 543 (1966).

[3] *Gillham, op.cit.; Wills, op.cit.; Pinkstaff vs Steffy,* 216 Ill. 406. 75 N.E. 163 (1905).

If the "common enemy doctrine" were in effect in Illinois, presumably the lower landowner could legally repel drainage waters in any manner he chose.

[4] *Gormley vs Sanford,* 52 Ill. 158 (1869); see also, *Baker vs Leka,* 48 Ill. App. 353 (1894).

[5] *Toledo, Wabash & West. Ry. Co. vs Morrison,* 71 Ill. 616 (1874); *Jacksonville, N.W. & S.E.R.R. Co. vs Cox,* 91 Ill. 500 (1879).

[6] *Graham vs Keene,* 143 Ill. 425, 32 N.E. 180 (1892).

[7] *Nevins vs City of Peoria,* 41 Ill. 502 (1866); *City of Aurora vs Reed,* 57 Ill. 29 (1870); *Elser vs Village of Grosse Point,* 223 Ill. 230, 79 N.E. 27 (1906).

[8] *Gormley vs Sanford,* 52 Ill. 158 (1869); *Tanner vs Valentine,* 75 Ill. 624 (1874).

[9] 109 Ill. 611 (1884).

[0] *Inlet Swamp Drainage District vs Mehlhausen,* 219 Ill. 459, 126 N.E. 113 (1920).

[1] *Lambert vs Alcorn,* 144 Ill. 313, 33 N.E. 53 (1893).

[2] *Fenton & Thompson R. Co. vs Adams,* 221 Ill. 201, 77 N.E. 531 (1906).

[3] *Templeton vs Huss,* 9 Ill. App. 3d 828, 292 N.E. 2d 530, reversed on other grounds 57 Ill. 2d 134, 311 N.E. 2d 141 (1974).

[4] *Fenton, op.cit.; Daum vs Cooper,* 208 Ill. 319, 70 N.E. 339 (1904).

[5] *Smith vs. City of Woodstock,* 17 Ill. App. 3d 948, 309 N.E. 2d 45 (1974).

[6] *Mauvaisterre Drainage and Levee District vs Wabash Ry. Co.,* 299 Ill. 299, 132 N.E. 559 (1921).

[7] *Zerban vs Eidmann,* 258 Ill. 486, 101 N.E. 925 (1913).

[8] 57 Ill. 2d 134, 311 N.E. 2d 141 (1974).

[9] *Beaver Drainage District No. 3 vs Cleveland C., C. & St. L. Ry. Co.,* 347 Ill. 122, 179 N.E. 429 (1932). The Eminent Domain Act is *Illinois Revised Statutes,* Chapter 47.

[0] *Chronic vs Pugh,* 136 Ill. 539, 27 N.E. 415 (1891).

[1] *Wessels vs Colebank,* 174 Ill. 618, 51 N.E. 639 (1898).

[22] Rules pertaining to drains and levees for mutual benefit apply even to highway commissioners. *Dunn vs Youmans,* 224 Ill. 34, 79 N.E. 321 (1906).

[23] *Adams vs Abel,* 290 Ill. 496, 125 N.E. 320 (1920).

[24] *King vs Manning,* 305 Ill. 31, 136 N.E. 730 (1922).

[25] Compare *Fobar vs Higginson,* 6 Ill. App. 2d 29, 126 N.E. 2d 521 (1955) (no duty to repair) with *Mackey vs Wrench,* 134 Ill. App. 587 (1908) (right to have mutual system maintained as established).

[26] *Fobar, op.cit.*

MODEL ORDINANCES

appendix e

BACKGROUND

MODEL ORDINANCES

ODEL ORDINANCE

ntroduction

ne Model Ordinance contained in this appendix has been developed in order to pro-
ide a potential measure to insure against the occurrence of future flood damageable
evelopment. It is presented for consideration by the local officials of the
uthwestern Illinois region. The ordinance is directed toward those aspects of
uture urban development which are directly and/or indirectly related to the prob-
ems of storm water drainage and periodic flooding. This Model Ordinance was de-
eloped to provide a viable solution to the need for regulatory measures identified
y the drainage study presented in this report and other similar studies. It fully
ecognizes that structural flood damages have occurred in developed areas with in-
dequate drainage facilities and in developed areas within flood plains of major
treams. Moreover, it is recognized that these damages will increase if development
s not regulated in areas identified as having significant drainage and flooding
roblems.

n the past, the most common method for preventing or alleviating flood damage has
een the implementation of structural measures such as levees, dams, flood walls,
tc. However, in many instances, this approach is becoming too costly to be
conomically justified, or the physical characteristics of the areas are not adapt-
ble to appropriate structures. In view of this situation, non-structural or reg-
latory measures to prevent or mitigate future urban flood damage are the most
racticable approach to the problem.

he classical answer to storm water drainage in the past has been to construct
arger and more efficient storm sewers. This has resulted in a greater volume of
ater being transported to receiving streams and canals. However, for a number of
ears, it has been known that economies could result from the temporary on-site
etention or storage of excessive storm waters. It was used in the development of
ilitary airfields during World War II where the runoffs from the sites would have
equired excessively large storm sewers or ditches. By temporarily retaining ex-
cess water in swales or depressed areas located between runways, the discharges
ere handled by smaller sized downstream failities.

This ordinance addresses four major problem conditions: (1) overbank flooding
areas, (2) inadequately drained areas, (3) high ground water areas, and (4) areas
where soil limitations are severe. Areas of overbank flooding, severe soil limitations, and seasonably high ground water table are identified elsewhere in this report and can be used for reference with the ordinance.

The Southwestern Illinois Metropolitan and Regional Planning Commission, Soil Conservation Service, State Water Survey, Illinois Division of Water Resources, Corps of Engineers, and the Federal Flood Insurance Administration are continuing studies within the planning area. More detailed information should result from these study efforts. Consequently, this ordinance should only be considered an interim ordinance and should be revised as additional information becomes available. Additionally, any unit of government considering adoption of this ordinance should consider the drainage aspects of any and all existing building or subdivision regulations. This should prevent duplication or contradiction of regulations. It may be beneficial to incorporate existing regulations related to drainage into the ordinance prior to adoption. Thus, by combining all drainage regulations under one cover, administration and enforcement could be more expedient and efficient.

The revised and adopted ordinance should be administered by Public Works Departments, city or county engineers or Drainage District engineers, and coordinated with the Zoning, Platting and Building Departments. All improvements should be inspected by the engineer, and a construction and maintenance bond should be mandatory for all improvements required or governed by this ordinance (normal requirements of the subdivision control ordinance).

The preparation of this ordinance was facilitated by the review of similar ordinances which have been successfully implemented elsewhere in Illinois. Special acknowledgment is extended to the Chicago Metropolitan Sanitary District, Northeastern Illinois Planning Commission, the Lake County Public Works Department, and the Illinois Department of Local Government Affairs for their assistance and recommendations.

AN ORDINANCE PROVIDING SUPPLEMENTARY SUBDIVISION, ZONING AND BUILDING CONSTRUCTION REGULATIONS IN ORDER TO MITIGATE OR ELIMINATE HAZARDS TO PERSONS AND DAMAGE TO PROPERTY CAUSED BY STORM WATER RUNOFF, HIGH GROUND WATER OR SPECIAL SOIL CONDITIONS.

e it ordained by, the (Governing Body) that the following on-site detention d wet soils ordinance is hereby enacted.

ARTICLE I

GENERAL CRITERIA AND STANDARDS

Section 100.0 PURPOSE AND INTENT

he drainage, dredging or filling in of wet soils results in a more rapid and reater volume of storm water runoff than would naturally occur. This, in turn, otentially increases flood levels elsewhere, soil erosion, sedimentation of water- ays and lakes, and pollution of water resources. Consequently, the tax-paying ublic is faced with the expensive proposition of constructing flood control struc- ures, widening the channels of drainageways, dredging sediment-filled waterways, nd providing relief to flood victims. The purpose of this ordinance is to mitigate r eliminate these problems, and more specifically to:

(a) Protect the health, safety, comfort and general welfare of the citizens of (Unit of Government);

(b) Preserve and protect natural flood storage areas;

(c) Control the amount and rate of subdivision storm water runoff;

(d) Maintain natural drainage courses sufficient to carry abnormal flows of storm water in periods of heavy precipitation;

(e) Prevent the future need for excessive public expenditures for water disposal;

(f) Help stabilize stream flow and reduce erosion and siltation;

(g) Protect surface and subsurface water quality;

(h) Retain sites for beneficial water uses such as flood control, water supply, wildlife habitat, and recreation;

(i) Protect areas important to the preservation of ecological systems;

(j) Protect citizens of (Unit of Government) from buying lands which are unsuited by location or other factors for their intended use because of their susceptibility to flooding or other water-related or soils problems;

(k) Facilitate the adequate provision of public facilities and utilities in the most economic manner;

(l) Prevent landowners from using their land in such a manner as to create a nuisance which adversely affects adjacent properties by unreasonably increasing storm water runoff, soil erosion, or other water-related problems.

100.1 SCOPE: In order to effect the above objectives, this ordinance:

(a) Regulates and restricts lot coverage, lot sizes, population density and distribution, and the location of all structures; and

(b) Requires that all land development projects be designed to achieve a harmonious relationship with the natural environment.

Section 101.0 APPLICABILITY

In those areas which have identified and delineated problems due to periodic flooding, inadequate storm water drainage, high ground water, or poor drainage related t impermeable clayey soils, the provisions of this ordinance shall be applicable to:

(a) Any residential development having a gross aggregate area of ten (10) acres or more; or

(b) Any residential development of less than ten (10) acres with a 50 percent impervious surface including roads, buildings, utility rights-of-way, and other improvements; or

(c) Any commercial, industrial, institutional or utility development having a gross aggregate area of three (3) acres or more.

Section 102.0 COMPLIANCE WITH OTHER ORDINANCES REQUIRED

Compliance with the requirements set forth in other applicable ordinances with respect to the submission and approval of preliminary and final subdivision plats, improvement plans, building and zoning permits, inspections, appeals and similar matters, and compliance with applicable State Statutes and regulations shall be a prerequisite to the commencement of any work regulated by this ordinance.

Section 103.0 LIMITATION OF STORM WATER RUNOFF

Downstream property owners, watercourses, channels or conduits shall not receive storm water runoff from proposed upstream developments at a higher peak flow rate than would have resulted from the same storm event occurring over the site of the oposed development with the land in its natural, undeveloped condition.

Section 104.0 ON-SITE DETENTION OF STORM WATER RUNOFF

orm water runoff resulting from a proposed development shall be detained on-site:

(a) By wet or dry bottom reservoirs;

(b) By underground reservoirs;

(c) On flat roofs, parking lots, or streets; or

(d) By other detention methods approved by (Department charged with inspection).

4.1 DESIGN STORM: Storm water detention facilities shall have sufficient capa-
ty to store flows up to the 100-year, 24-hour rainstorm (see Section 105.0).

4.2 RAINFALL DATA: For purposes of designing adequate on-site detention faci-
ities, the Illinois State Water Survey rainfall data for this region shall be
sed.

Section 105.0 RELEASE OF DETAINED STORM WATER

n certain areas of this region surface topography impedes free drainage and
xisting drainage channels are inadequate to carry storm water runoff. Consequently,
torm water detained on-site in accordance with Section 104.0 may be released as
llows:

(a) In areas that have a drainage outlet such as a stream, canal or ditch, storm water may be released from the detention facility at a rate not to exceed the runoff rate produced by a 10-year, 24-hour rainstorm under undeveloped conditions, or the capacity of the receiving stream, whichever is less.

(b) In areas that have no natural drainage outlet, all additional storm water runoff resulting from the development up to the amount generated by a 100-year, 24-hour rainstorm shall be stored on-site. Water may be released from the detention facility, as provided above, only if the landowner is able to construct an adequate storm water outfall or ditch. Construction of such storm sewer or ditch shall be at the landowner's expense.

Section 106.0 STORM WATER BYPASS

rainage systems shall have adequate capacity to bypass through the development the
low from all upstream areas for a storm of design frequency calculated on the basis
f the upstream land in its fully developed state under present zoning or zoning

proposed in accordance with the comprehensive plan adopted by the (Governing Body). An allowance may be made for upstream detention.

Section 107.0 JOINT DEVELOPMENT OF CONTROL SYSTEMS

Storm water control systems may be planned and constructed in coordination by two or more developments so long as they are in compliance with Sections 101.0 through 106.0.

Section 108.0 INSTALLATION OF CONTROL SYSTEMS

Runoff systems shall be installed prior to any occupancy of the new development. Detention basins shall be designed with additional capacity to allow for sediment accumulation resulting from development.

ARTICLE II

SUBDIVISION AND IMPROVEMENT REGULATIONS

Section 200.0 INFORMATION REQUIREMENTS

The following information and data prepared by a licensed professional engineer shall accompany the preliminary plans and plats of each proposed residential, commercial or industrial development.

200.1 CONTOUR MAP: A topographic map of the land to be subdivided and such adjoining land whose topography may affect the layout or drainage of the subdivision. The contour interval shall be one (1) foot when slopes are less than 4 percent and shall be two (2) feet when slope exceeds 4 percent. On this map, the following shall be shown:

(a) The location of streams and other floodwater runoff channels, their normal channels, and extent of the flood plains at the established 100-year flood elevations where available, and the limits of the floodway, all properly identified;

(b) The normal shoreland of lakes, ponds, swamps and detention basins, their flood plains, and lines of inflow and outflow, if any;

(c) The location of farm drains, inlets and outfalls if any of record;

(d) Storm, sanitary and combined sewers and outfalls, if any of record;

(e) Septic tank systems and outlet, if any of record;

(f) Seeps, springs, flowing and other wells, that are visible or of record.

00.2 PRELIMINARY DRAINAGE PLAN: A comprehensive plan, in preliminary form (or in ombined preliminary and final plan form), designed to handle safely the storm ater runoff and detain the increased storm water runoff. The plan shall provide r be accompanied by maps or other descriptive material indicating the feasibility f the drainage plan and showing the following:

(a) The extent and area of each watershed affecting the design of detention facilities as shown on U.S.G.S Survey Maps;

(b) The preliminary layout and design of street storm sewers, where proposed, and other storm drains to be built, the outfall and outlet locations and elevations, receiving stream or channel and its 100-year, 24-hour storm water elevation;

(c) The location and design of the proposed street system where pavements are planned to be depressed sufficiently to convey or temporarily store overflow from the heavier rainstorms and outlets for such overflow;

(d) Existing streams and flood plains to be maintained, and new channels to be constructed, their locations, cross sections and profiles;

(e) Proposed culverts and bridges to be built, their materials, elevations, waterway openings and basis of their design;

(f) Existing detention ponds and basins to be maintained, enlarged, or otherwise altered and new ponds or basins to be built and the basis of their design;

(g) The estimated depth and amount of storage required by design of the new ponds or basins;

(h) The estimated location and percentage of impervious surfaces existing and expected to be constructed when the development is completed;

200.3 VALLEY CROSS SECTION: One or more typical cross sections of all existing and proposed channels or other open drainage facilities, showing the elevation of the existing land and the proposed changes thereto, together with the high water elevations expected from the 100-year storm under the controlled conditions called for by this ordinance, and the relationship of structures, streets and other utilities.

200.4 SITE PLAN: A plan showing the dimensions of the site with existing and proposed structures properly located, together with one (1) foot contours of the terrain after the proposed grading, if any, has been completed (see also Article III).

Section 201.0 FINAL DRAINAGE PLANS

Upon approval of the preliminary drainage plans by the (Department charged with inspection), a final drainage plan shall be submitted to the (Department charged with inspection) in accordance with Section 500.0. The final plan shall provide or be accompanied by maps and/or other descriptive material showing the following:

(a) The extent and area of each watershed tributary to the drainage channels in the development;

(b) The street storm sewers and other storm drains to be built, the basis of their design, and outfall and outlet locations and elevations, receiving stream or channel and its high water elevation, the functioning of the drains during high water conditions;

(c) The parts of the proposed street system where pavements are planned to be depressed sufficiently to convey or temporarily store overflow from storm sewers and over-the-curb runoff resulting from the heavier rainstorms and the outlets for such overflow;

(d) Existing streams and flood plains to be maintained, and new channels to be constructed, their locations, cross sections and profiles;

(e) Proposed culverts and bridges to be built, their materials, elevations, waterway openings and basis of design;

(f) Existing detention ponds and basins to be maintained, enlarged, or otherwise altered and new ponds or basins to be built and the basis of their design;

(g) The estimated location and percentage of impervious surfaces existing and expected to be constructed when the development is completed;

(h) The slope, type, and size of all sewers and other waterways;

(i) For all detention basins, a plot or tabulation of storage volumes with corresponding water surface elevations and of the basin outflow rates for those water surface elevations;

(j) For all detention basins, design hydrographs of inflow and outflow for the 100-year peak flows from the site under natural and developed conditions.

Section 202.0 DETENTION BASIN DESIGN

Detention basins shall be constructed to temporarily detain the storm water runoff. The following design principles shall be observed;

(a) The maximum planned depth (without a permanent pool) shall not exceed five (5) feet;

(b) The approach slopes of the basin will conform as closely as possible to natural land contours. Erosion control measures shall be provided as well as devices or measures to insure public safety;

(c) Levee side slopes shall not exceed 1:3;

(d) Outlet control structures shall be designed as simply as possible and shall operate automatically; they shall be designed to limit discharges into existing predetermined safe capacities and not in excess of flows which would have occurred with the land in its natural, undeveloped condition (see Section 105.0);

(e) Emergency overflow facilities must be provided unless positive measures are installed to control the inflow so as not to exceed the safe capacity of the basin.

.1 WET BOTTOM BASINS: Where part of a detention basin will contain a permanent ol of water, the following requirements shall apply:

(a) The minimum normal depth of water before the introduction of storm water shall be four (4) feet;

(b) For emergency purposes, cleaning or shoreline maintenance, facilities shall be provided or plans prepared for the use of auxiliary equipment to permit emptying and drainage;

(c) Aeration facilities may be required, dependent on the quality of the influent and detention time;

(d) Approach slopes shall be at 6:1 but not more than 3:1 and shall be at least four (4) feet to six (6) feet wide and sloping gently towards basin. The side slopes shall be a non-erosive material with a slope of 1:1 or flatter. The ledge shall be four (4) feet to six (6) feet wide and sloping gently toward the shore to prevent people or objects from sliding into deep water. There shall be a freeborad of twelve (12) inches to eighteen (18) inches above the high-water elevation on all wet bottom basins. Alternate designs for side slopes may be considered under special circumstances where good engineering practice is demonstrated.

2.2 DRY BOTTOM BASINS: Detention basins which will not contain a permanent pool water shall comply with the following requirements:

(a) Provisions must be incorporated to facilitate interior drainage, to include the provision of natural grades to outlet structures, longitudinal and transverse grades to perimeter drainage facilities, or the installation of subsurface drains.

(b) These basins may be designed to serve secondary purposes for recreation, open space or other types of use which will not be adversely affected by occasional or intermittent flooding.

Section 203.0 SUBDIVISION DESIGN REGULATIONS

Improvements to control the runoff of storm water from or within the subdivision shall be designed in accordance with the following provisions:

203.1 DESIGN: Streets, blocks, depths of lots, parks and other public grounds shall be located and laid out in such a manner as to reduce the velocity of overland flow and allow the maximum opportunity for infiltration of storm waters into the ground, and to preserve and utilize natural streams, channels and detention basins, including wherever possible the largest streams and flood plains within parks or other public grounds.

203.2 CHANNEL REALIGNMENT: Meandering streams or channels may be partly straightened and minor changes made in other channels where it can be demonstrated that downstream flooding will not be increased in frequency or depth.

203.3 LESSER CHANNEL LOCATIONS: A drainage easement of at least twenty (20) feet in width shall be provided and shown on the plat. The easement shall permit necessary public channel maintenance and improvement work and access of equipment therefore, but shall prohibit buildings, fences, shrubbery, trees, and other obstructions to flow. Generally acceptable locations of the lesser storm water runoff channels in the design of a subdivision may include the following:

(a) In a depressed median of a double roadway, street or parkway, provided the median is wide enough to permit flat side slopes.

(b) Centered on the rear lot lines in a block, or entirely within the rear yards of a single row of lots or parcels, provided that in either case the lots are deep enough to permit flat side slopes and a building site above the established high water elevation plus two feet on the front part of the lot.

203.4 STORM SEWER OUTFALL: Storm sewer outfall shall be so designed, with respect to the elevation of the invert, installation of pumps or other features, that when the receiving stream is in full flood, the storm sewer will continue to drain the area it is designed to serve.

203.5 STREETS DESIGNED FOR DETENTION: Cross sections and grades of streets located above high water elevations shall be designed to temporarily store and convey flows in excess of storm sewer capacities, together with over-the-curb runoff and shall be provided with adequate outlets for the safe disposal of such overflow. The street cross-section shall provide a lot grade for each adjoining building at least two (2) feet higher than the crown of the pavement, and the minimum sill elevation of openings in the outer walls of such habitable buildings shall be at least two and one-half (2.5) feet above the crown elevation.

203.6 MANHOLES: All sanitary sewer manholes constructed in a flood plain, in a street designed for detention, or in a natural ponding area, shall be provided with either a watertight manhole cover or be constructed with a rim elevation of a nimum of two (2) feet above the high water elevation of the design flood or the gh water elevation of the design storm, whichever is applicable to the specific ea.

Section 204.0 INSPECTION OF FACILITIES

e (Department charged with inspection) shall inspect all drainage facilities eing constructed in order to ensure that such facilities are completed according to pproved plans. The (Department charged with inspection) is hereby authorized to ompel compliance with such plans by appropriate legal action.

Section 205.0 DEDICATION OF FACILITIES

edication and maintenance responsibility for drainage facilities shall be deter- ined before the final drainage plans are approved. This may be accomplished in ne of two ways:

05.1 PUBLIC RESPONSIBILITY: Whenever drainage facilities are planned to service everal projects or a specific area deemed necessary by the (Unit of Government) ne drainage facilities may be dedicated to the (Unit of Government) . When these rojects are of a regional nature, the (Unit of Government) will maintain these acilities.

05.2 HOMEOWNERS ASSOCIATION: The developer of a subdivision shall be responsible or the maintenance of all storm water control improvements serving such subdivision ntil completion of eighty percent (80%) of the development. Thereafter, he shall ransfer these improvements to the Homeowners Association for maintenance purposes, ut only after he has received final approval, final inspection, and a Certificate f Compliance from the (Department charged with inspection) in accordance with ection 502.0.

Section 206.0 HOMEOWNERS ASSOCIATION

A Homeowners Association shall be formed in perpetuity in every subdivision hereafter developed in this (Unit of Government) for the purpose of maintaining drainage facilities.

(a) Membership by all subdivision property owners shall be mandatory.

(b) All drainage improvements shall be maintained in perpetuity and shall not be developed for any other use which would limit their primary use. The improvements shall be owned and maintained by the Homeowners Association of the development and each property owner shall own a proportionate responsibility for the continued maintenance.

(c) Each property owner shall, within the contents of his deed, be liable for the combined maintenance of the improvements. A special note to that effect shall appear on any final plat of subdivision or any plat of condominium and their declarations.

(d) The Homeowners Association shall select from its membership one proerty owner to serve as the Association's agent for the receipt of judicial and governmental notices.

Section 207.0 INADEQUATE MAINTENANCE

Whenever the (Department charged with inspection) determines, by inspection, that the drainage facilities of a particular subdivision are malfunctioning, said (Department) shall send by certified mail to the agent of the Homeowners Association written notice directing the Association to take appropriate corrective action(s) within a reasonable time. Procedures and appeals shall be in accordance with Section 501.1.

ARTICLE III

BUILDING REGULATIONS

Section 300.0 PLAN APPROVAL

Plans for construction of improvements and structures must be submitted for review to the (Department charged with inspection) either prior to or in conjunctio with preliminary and final plat filings.

(a) No plan shall be approved unless it complies with every applicable provision of this ordinance.

(b) The (Building and Zoning Department) shall not issue a building permit or approve a final plat until they have received a letter from the (Department charged with inspection) indicating approval of the construction plans.

Section 301.0 HIGH WATER TABLE AREAS

Construction in areas characterized by high water tables requires very detailed planning because in those areas buildings may flood and underground utilities may rupture. These occurrences, in turn, pose serious health and safety hazards, and cause economic detriment. Therefore in identified high water table areas, the following requirements shall be met:

1.1 DESIGN: Construction plans and data prepared by a licensed professional gineer shall be submitted for review to the (Department charged with inspection). e engineer should consider, and design solutions for the following:

(a) Hydrostatic pressures exerted on buildings, underground utilities and streets;

(b) Methods to dewater or lower ground water levels;

(c) Effect of ground water on detention basins.

)1.2 ADDITIONAL REQUIREMENTS: In addition to the requirements imposed by ection 301.1, the (Department charged with inspection), as a condition to the oproval of construction plans, may require any of the following:

(a) Reinforced building foundations, pavements and thicker sub-base;

(b) Curtain drains, footing drains and sump pumps with graded filters;

(c) Pressure relief wells; specialized waterproofing techniques;

(d) That no building have a sub-surface basement;

(e) Any additional requirement necessary to protect improvements or structures.

01.3 ON-LOT SEWAGE DISPOSAL: On-lot sewage disposal systems utilizing a soil bsorption system shall not be allowed unless the bottom of the disposal field rench will lie at least four (4) feet above the highest possible water table level n the natural soil. If fill is to be used to elevate the system, at least four 4) percolation tests by a licensed professional engineer conducted in the com- acted fill material shall be submitted to the (Department charged with inspection).

Section 302.0 SEVERE SOILS AREAS

everal soils are limited by characteristics such as a high clay content, high hrink-swell potential, high frost heave potential, seasonal high water table and ery slow permeability. Consequently, areas characterized by such soils have evere limitations for most urban uses. Therefore, in severe soils areas, the ollowing requirements shall be met:

302.1 DESIGN: Plans and data prepared by a licensed professional engineer with experience and education in soil mechanics shall be submitted to the (Department charged with inspection). The engineer should consider and design solutions for the following:

(a) Frost heave potential;

(b) Shrink-swell potential;

(c) Poor soil-bearing strength;

(d) Poor water infiltration;

(e) Poor soil-settling characteristics.

302.2 ADDITIONAL REQUIREMENTS: In addition to the requirements imposed by Section 302.1, the (Department charged with inspection), as a condition to the approval of construction plans, may require any of the following:

(a) Reinforced building foundations, pavement and thicker sub-base;

(b) Special soil treatment techniques;

(c) Special fill and backfilling procedures;

(d) Soil core borings to bedrock;

(e) Detailed soils analyses and mapping;

(f) Modification of structures;

(g) Any additional requirement necessary to protect improvements or structures.

Section 303.0 ROOFTOP STORAGE

Detention storage requirements may be met in total or in part by detention on flat roofs. Details of such designs to be included in the building permit applications shall include the depth and volume of storage, details of outlet devices and downdrains, elevations of overflow scuppers, design loadings for the roof structure and emergency overflow provisions. Direct connection of roof drains to sewers or streets is prohibited.

Section 304.0 PARKING LOT STORAGE

Paved parking lots may be designed to provide temporary detention storage of storm waters on all or a portion of their surfaces. Outlets will be designed so as to slowly empty the stored waters, and depths of storage must be limited so as to prevent damage to parked vehicles.

Section 305.0 DETENTION STORAGE

All or a portion of the detention storage may also be provided in underground or surface detention facilities, to include basins, tanks or swales.

ARTICLE IV

DEFINITIONS

Section 400.0 DEFINITIONS

or the purposes of this ordinance, the following definitions are adopted:

00.1 CAPACITY OF A STORM DRAINAGE FACILITY: The maximum ability of a storm rainage facility to convey storm water flows without causing damage to ublic or private property.

00.2 CHANNEL: A natural or artificial watercourse of perceptible extent which eriodically or continuously contains moving water, or which forms a connecting ink between two bodies of water. It has a definite bed and banks which serve to onfine the water.

00.3 CHANNEL LINES: Predetermined lines bounding an existing or proposed water- ourse, to include the easement or right-of-way, the total width of which will ermit the transmission of peak flows along the watercourse.

00.4 CONDUIT: A general term for any channel, pipe, sewer or culvert used for he conveyance or movement of water, whether open or closed.

00.5 DETENTION STORAGE: The temporary detailing or storage of storm water in eservoirs, on rooftops, in streets, parking lots or other areas under predeter- ined and controlled conditions, with the rate of drainage thereform regulated by ppropriately installed devices.

00.6 DISCHARGE: The outflow of water, silt or other mobile substances passing long a conduit or a channel or released from detention storage.

00.7 DRAINAGE AREA: The contributing area to a single drainage basin, expressed n acres, square miles or other units of area; also called catchment area, water- hed or river basin; the area served by a drainage system or by a watercourse re- eiving storm and surface waters.

400.8 DRAINAGE BASIN: The area from which water is carried off by a drainage ystem; a watershed or catchment area.

400.9 ONE HUNDRED-YEAR STORMS: Rainstorms of varying durations and intensities xpected to recur on the average of once every one hundred years (a one (1) per- ent chance of occurring in any one year).

400.10 PEAK FLOW: The maximum rate of flow of water at a given point in a channel or conduit resulting from a predetermined storm or flood.

400.11 STORM WATER DRAINAGE SYSTEM: All facilities used for conducting storm water to, through or from a drainage area to the point of final outlet, including but not limited to any of the following: conduits and appurtenant features; canals; channels; ditches; streams; culverts; streets and pumping stations.

400.12 STORM WATER DRAINAGE FACILITY: Any element in a storm water drainage system which is made or improved by man.

400.13 STORM WATER RUNOFF: The waters derived from rains falling within a tributary drainage basin, flowing over the surface of the ground or collected in channels or conduits.

400.14 URBANIZATION: The development, change or improvement of any parcel of land consisting of one or more lots for residential, commercial, industrial, institutional, recreational or public utility purposes.

400.15 WATERCOURSE: Any stream, creek, brook, branch, natural or artificial depression, slough, gulch, reservoir, lake, pond or natural or man-made drainageway in or into which storm water runoffs and floodwaters flow either regularly or intermittently.

ARTICLE V

ADMINISTRATION

Section 500.0 ADMINISTRATIVE RESPONSIBILITY

The administration of this ordinance shall be the responsibility of the (Department charged with inspection). However, whenever a specific provision of this ordinance clearly falls within the jurisdiction of any other commission or department, responsibility for the administration of such provision(s) is hereby transferred to such department provided that:

500.1 VARIANCES: No variance from the requirements of this ordinance shall be granted without the prior concurrence of the (Department charged with inspection).

500.2 SPECIAL USE PERMIT: No special use permit shall be granted without the prior concurrence of the (Department charged with inspection).

500.3 OFFICIAL MAPS AND PROFILES: Responsibility for all changes to official maps and profiles shall remain with the (Department charged with inspection).

Section 501.0 PROCEDURES TO CORRECT MALFUNCTIONING DRAINAGE FACILITIES

n accordance with Section 207.0, whenever the (Department charged with inspection) etermines that the drainage facilities of a particular subdivision are not unctioning properly, said Department shall notify the agent of the Homeowners ssociation to correct the drainage problem.

01.1 CONTENTS OF NOTICE: The notice to take corrective action(s) shall contain:

(a) A description of what constitutes the drainage problem;

(b) The location of the drainage problem;

(c) A statement of what condition or state of affairs must be achieved in order for the drainage problem to be deemed corrected;

(d) A statement suggesting what corrective actions should be taken;

(e) The date or time by which the drainage problem must be corrected;

(f) The date or time by which an appeal of the correction order must be filed and a statement of the procedure for so filing;

(g) A statement that if the drainage problem is not corrected by the date prescribed and no request for hearing is made within the time prescribed, this unit of government will correct it and assess the costs against the Homeowners Association and/or impose a fine.

01.2 HEARING: The Homeowners Association ordered to correct a drainage problem ay have a hearing with the chief officer of the (Department charged with inspecion). A request for a hearing must be made in writing and delivered to the chief fficer of the (Department) within the time stated in the notice; otherwise, it ill be presumed that a drainage problem exists, and that such problem must be orrected as ordered. The hearing shall not be a formal trial-type proceeding, ut appropriate procedural safeguards shall be observed to ensure fairness. At he conclusion of the hearing, the chief officer shall render a written decision. f he decides in the affirmative, he must order the problem corrected within an dditional time which must be reasonable under the circumstances.

01.3 APPEAL: The Homeowners Association may appeal to the (Governing Body) an dverse decision rendered after the hearing provided for in Section 501.2. Such ppeal may be taken by filing with the clerk of the (Unit of Government) within number) of days of such adverse decision a written statement indicating the basis f the appeal.

he appeal shall be heard by the (Governing Body) within (number) days after such iling. Their findings shall be conclusive and, if a drainage problem is found to xist, it shall be ordered corrected within a time reasonable under the circumstances.

501.4 CORRECTION BY THE (UNIT OF GOVERNMENT): If the Homeowners Association notified to correct a drainage problem fails to correct as directed, or if the drainage problem poses an emergency, this (Unit of Government) shall perform the required corrective action keeping an accurate account of the expense incurred. The corrective action keeping an accurate account of the expense incurred. The itemized expense account shall be filed with the clerk of this (Unit of Government), who shall pay such expenses on behalf of the (Unit of Government).

501.5 RECOVERY OF COST OF CORRECTION: The clerk of the (Unit of Government) shall mail a statement of the total expense incurred to the Homeowners Association which has failed to abide by the notice to correct the drainage problem and if the amount has not been paid within (number) days, such costs shall constitute a lien on each owner's property. After the expiration of (number) days, notice of such liens shal be filed in the office of the Recorder of Deeds of (name) County.

Section 502.0 CERTIFICATE OF COMPLIANCE

Upon approval and inspection of all facilities governed by this ordinance, the (Department charged with inspection) shall issue a certificate of compliance. Said certificate shall include a listing of all maps, drawings and plans; dates of inspection; and be signed by the (Chief Officer) of the (Department charged with inspection). Said certificate shall be filed with all final plans.

ARTICLE VI

SAVINGS CLAUSES, PENALTIES, ADOPTION

Section 600.0 INTERPRETATION

In the interpretation and application of this ordinance, the provisions expressed herein shall be held to be the minimum requirements and shall be liberally construed in favor of the (Unit of Government) and shall not be deemed a limitation or repeal of any other powers granted by State Statutes.

Section 601.0 ABROGATION AND GREATER RESTRICTIONS OF PROPERTY RIGHTS

It is not intended by this ordinance to repeal, abrogate, or impair any existing easements, covenants or deed restrictions. However, where this ordinance imposes greater restrictions, the provision of this ordinance shall prevail.

Section 602.0 DISCLAIMER OF LIABILITY

e degree of protection required by this ordinance is considered reasonable for
gulatory purposes and is based on historical records, engineering and scientific
thods of study. Larger storms may occur or storm water runoff heights may be
creased by man-made or natural causes. This ordinance does not imply that land
es permitted will be free from storm water damages. This ordinance shall not
eate liability on the part of the (Unit of Government) or any officer or employee
ereof for any damages which may result from reliance on this ordinance or on any
ministrative decision lawfully made thereunder.

Section 603.0 PENALTIES

olation of the provision of this ordinance or failure to comply with any of its
equirements, including conditions and safeguards shall constitute a misdemeanor.
ny person who violates this ordinance or fails to comply with any of its require-
ents shall upon conviction thereof be fined not more than (amount) dollars,
nd in addition, shall pay all costs and expenses involved in the case. Each day
uch violation continues shall be considered a separate offense.

Section 604.0 CORRECTIVE ACTION

othing herein contained shall prevent the (Unit of Government) from taking such
ther lawful action as is necessary to prevent or remedy any violation. All such
osts connected therewith shall accrue to the person or persons responsible.

Section 605.0 REPEALER

ll ordinances or parts thereof in conflict with the provisions of this ordinance
re repealed.

Section 606.0 SEVERABILITY

he invalidity of any provision of this ordinance shall not affect the validity of
he remainder of this ordinance.

Section 607.0 WHEN EFFECTIVE

his ordinance shall become effective after its final passage, approval, and publi-
ation as required by law.

Passed by the (Governing Body) this _____ day of ______________________, 19___.

Aye _____

Nay _____

____
Clerk

Approved by the (Chief Elected Official) this _____ day of ________________,
19___.

____
(Chief Elected Official)

Attest:

____
Clerk

Effective Date:

____________________, 19___

GROUNDWATER DATA

appendix f

GROUNDWATER HAZARDS
TO UNDERGROUND
CONSTRUCTION IN THE
AMERICAN BOTTOMS

BY WILLIAM H. BAKER
ASSISTANT HYDROLOGIST
ILLINOIS STATE WATER SURVEY

PLATE F-1
GROUNDWATER HAZARD AREAS
JUNE, 1973

PLATE F-2
GROUNDWATER LEVEL CONTOURS
JUNE, 1973

GROUND WATER HAZARDS TO UNDERGROUND CONSTRUCTION IN THE AMERICAN BOTTOMS

By William H. Baker
Assistant Hydrologist
Illinois State Water Survey

ITRODUCTION

ost of the Mississippi River flood plain in Madison and St. Clair Counties known s the American Bottoms has been plagued by high ground water levels since the near-ecord flood on the Mississippi River in 1973. Record high ground water levels ave occurred due to favorable conditions for ground water recharge. As a result ewer lines have ruptured and basements have flooded. Areas which were previously ry and well-drained are now subject to surface flooding due to the saturated conition of the ground water reservoir.

ground water hazard map (Plate F-1) was prepared to delineate the areas of the nerican Bottoms subject to high ground water levels which would effect underground tilities and basements. The map should also serve as a guide in determining zonng and construction regulations related to underground construction.

AP PREPARATION

ata for the preparation of a ground water level contour map (Plate F-2) were colected in June 1973 at the peak of high ground water during the near record flood n the Mississippi River. The ground water level contour map was transposed onto and surface topographic maps of the area. Both maps have contour intervals of 5 eet. A grid with a spacing of 1/4 mile was used to aid in comparing the two maps. or each grid intersection the procedure for determining the depth to water was as ollows:

1. Determine the contour range for the grid intersection on the topographic map.
2. Determine the contour range for the same grid intersection on the water level contour map.
3. Subtract the water level range from the land surface range.
4. Determine a mean depth to water below land surface at the grid intersection.

The procedure was repeated for each grid intersection thus establishing values of depth to water below land surface for contouring.

It was found that underground utilities in the American Bottoms exist at depths of from 5 to 25 feet, probably averaging 12 feet, and residence basement floors from 3 to 8 feet below ground surface. For the most part, underground utilities and basements were not specifically designed to withstand the pressures of high ground water levels. Therefore, the term "below-ground construction" refers to basements and utilities as they presently exist throughout most of the area.

Explanation of the color coding of the ground water hazard map is given below:

1. In the red areas high ground water levels ranged from land surface to 8 feet below land surface. All below-ground construction should be avoided unless precautionary design procedures are followed.

2. In the yellow areas high ground water levels ranged from 8 to 18 feet below land surface. Basement construction should be relatively safe. Below-ground construction for the deeper utilities should be avoided unless precautionary design procedures are followed.

3. In the green areas high ground water levels are more than 18 feet below land surface. Except for the deeper utilities, below-ground construction is relatively safe.

DISCUSSION

Ground water levels are constantly changing due to natural drainage, changes in recharge, changes in pumping rates by public and industrial water supplies and evapotranspiration. As a result, the configuration of the ground water surface changes and areas which are mapped as caution areas could become areas of greater hazard potential. The reverse is also possible but much less probable. Due to fine grained materials of varying thickness found at or near the ground surface, water levels higher than those mapped (Plate F-2) may be found in some locations. These levels do not reflect the levels of the main ground water system in the American Bottoms. Where these higher levels exist they compound the problem and add to the ground water hazard potential.

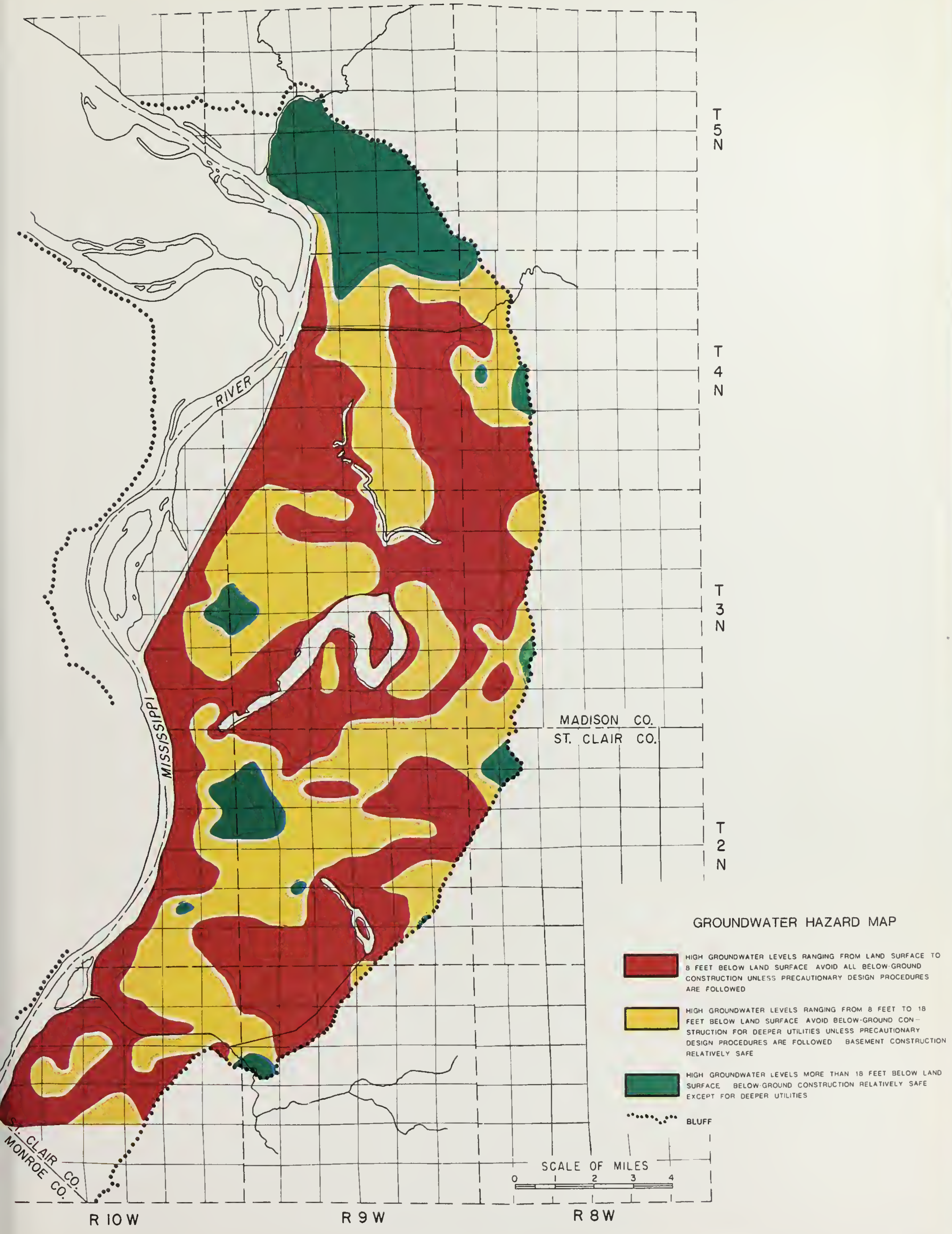
The ground water hazard map was constructed as a guide to be used by planning agencies, zoning and building authorities, municipal officials and contractors in the further development of the American Bottoms. Through the proper use of these maps it is hoped that future problems in this development due to high ground water levels can be minimized.

June 24, 1975

PLATE F-1

Groundwater Hazards June, 1973

AMERICAN BOTTOMS

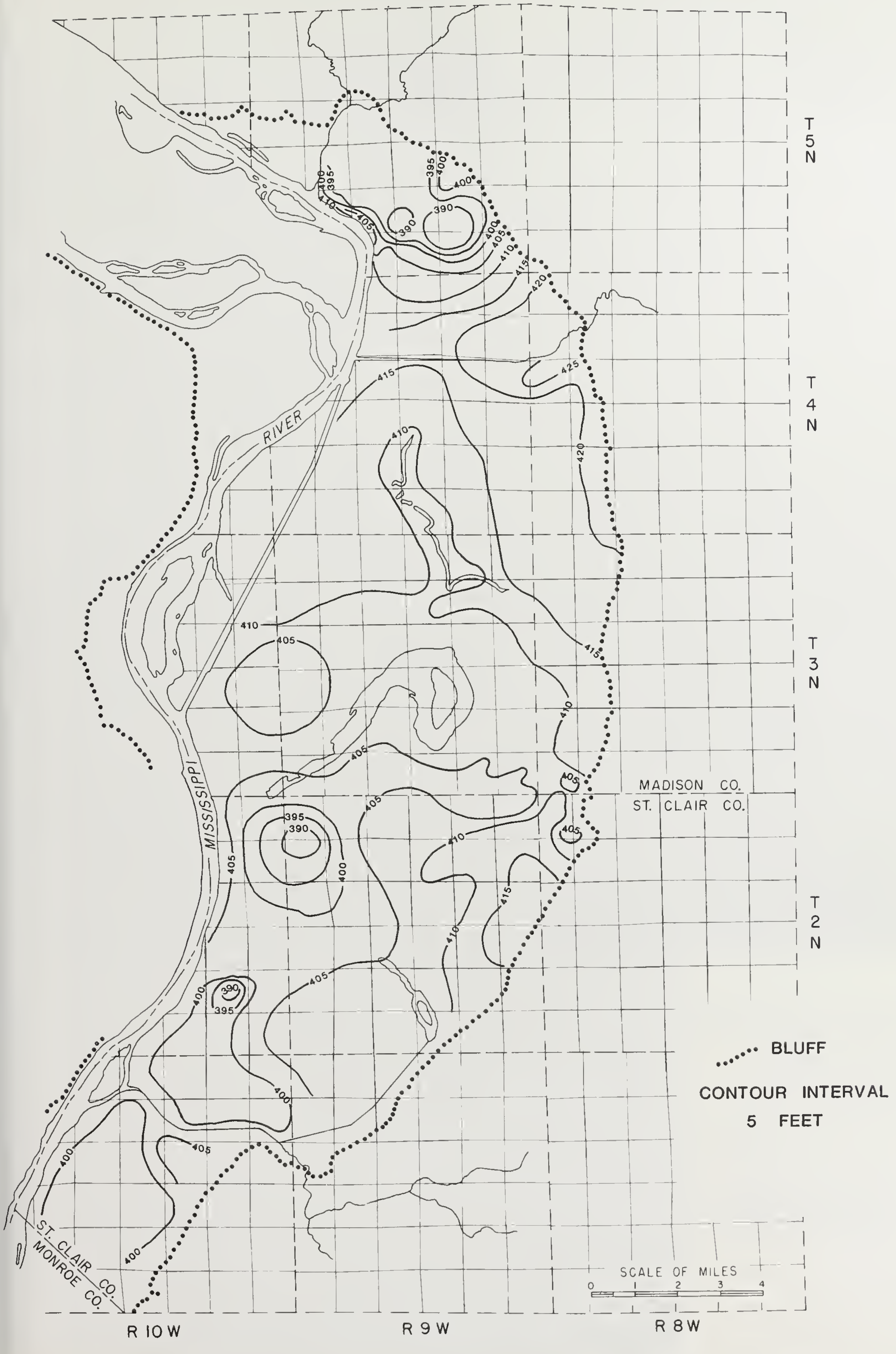

T 5 N
T 4 N
T 3 N
T 2 N
RIVER
MISSISSIPPI
MADISON CO.
ST. CLAIR CO.
ST. CLAIR CO.
MONROE CO.
R 10 W
R 9 W
R 8 W
SCALE OF MILES
0
1
2
3
4
GROUNDWATER HAZARD MAP
🟥 HIGH GROUNDWATER LEVELS RANGING FROM LAND SURFACE TO 8 FEET BELOW LAND SURFACE AVOID ALL BELOW-GROUND CONSTRUCTION UNLESS PRECAUTIONARY DESIGN PROCEDURES ARE FOLLOWED
🟨 HIGH GROUNDWATER LEVELS RANGING FROM 8 FEET TO 18 FEET BELOW LAND SURFACE AVOID BELOW-GROUND CONSTRUCTION FOR DEEPER UTILITIES UNLESS PRECAUTIONARY DESIGN PROCEDURES ARE FOLLOWED BASEMENT CONSTRUCTION RELATIVELY SAFE
🟩 HIGH GROUNDWATER LEVELS MORE THAN 18 FEET BELOW LAND SURFACE BELOW-GROUND CONSTRUCTION RELATIVELY SAFE EXCEPT FOR DEEPER UTILITIES
BLUFF

SOURCE: ILLINOIS STATE WATER SURVEY

PLATE F-2

Groundwater Level Contours June, 1973

AMERICAN BOTTOMS



SOURCE: ILLINOIS STATE WATER SURVEY

GEOLOGIC DATA

appendix g

GEOLOGIC CONDITIONS
RELATED TO
CONSTRUCTION

ENGINEERING DATA

EOLOGIC CONDITIONS RELATED TO CONSTRUCTION

ologic hazards are a result of natural causes or of human activities. Examples of
tural hazards include: natural high levels of saturation, the presence of clays
th excessive shrinkage and swelling qualities, the presence of organic soils that
mpress under small loading, silts and sands unstable due to quick conditions, and
stable slopes caused by natural erosion processes. Human activities may tend to
gravate existing conditions or create new problems. Examples are: the instal-
tion of septic systems that contribute additional water to the ground water rais-
g levels of saturation; construction of dams and levees that increase levels of
turation; excavation and cuts for construction projects that expose unstable sods
remove stabilizing toe material; changes in soil cover, drainage patterns, or
rfacing materials so as to upset the natural ground water patterns causing shrink-
e, swelling, or unstable conditions; and finally, activities such as mining that
eate subsurface openings that eventually may collapse and result in subsidence of
e surface.

owledge of the geology of the basin area is important to site selection and de-
gn of a project. Cahokia Alluvium and Equality Formation are subject to severe
ter conditions and may include areas of undesirable clay beds, compressible organ-
materials or silts in a quick condition. Peyton Colluvium is characteristically
sociated with sensitive slopes subject to possible failure and creep. High levels
saturation and unstable conditions are common to some areas of the Peoria Loess
d Roxana Silt. Construction of levees along the Mississippi and dams along trib-
tary streams raise levels of saturation of Cahokia, Peyton, Equality, and Henry
rmations in adjacent slopes. Installation of home septic systems in fine-
xtured Peoria and Roxana formations also raises levels of saturation. Excavations
d cuts for roads and building sites in Peyton, Peoria, and Roxana formations can
use slopes to become unstable or expose seepage zones along bed contacts. Refuse,
oil, and other debris that produce harmful leachate may cause more extensive
llution in areas of Parkland Sand or Mackinaw Member sands and gravels.

ollapse of mined-out areas will affect any formation that overlies the opening.
nitial subsidence due to mining generally takes place within a few weeks to months.
ur studies indicate that problems from subsidence may develop more than fifty years
fter mining. The long-term aspect of mine instability should be considered for any
onstruction in mined-out areas. Shallow bedrock areas in the vicinity of the
ississippi River bluffs may be unstable. Excavation of these materials may prove
o be difficult.

NGINEERING DATA*

he Engineering Data Table is a compilation of existing information on the engin-
ering properties of the geologic map units on the Surface Geology Map. Because it
s largely a subsurface unit, the Glasford Formation is included in the data table,
ut not on the map. The Glasford Formation is mostly glacial till and is the de-
osit usually found immediately beneath the surficial loess deposits.

TABLE G-1 ENGINEERING PROPERTIES OF GEOLOGIC DEPOSITS

GEOLOGIC UNIT		MATERIAL TYPE	GRAIN SIZE			THICKNESS (feet)	SLOPE	BEARING CAPACITY	FROST HEAVE	EROSION	WATER TABLE	PERME-ABILITY	STANDARD PENETRATION TEST (blows)	SHEAR STRENGTH (Qu, tsf)	NATURAL WATER
			SAND %	SILT %	CLAY %										
CAHOKIA ALLUVIUM	AMERICAN BOTTOMS	CLAY, SILT, SILTY SAND	5-45	40-70	10-45	20-70	LEVEL TO DEPR.	LOW TO MED	HIGH	LOW TO MED.	HIGH	LOW TO MED.	1-15* (5) *370*	.1-2.5 (1.0) *308*	15-5 (30 *187*
	FANS & UPLAND STREAMS	SILT, CLAYEY SILT	5-30	45-80	10-35	5-45	LEVEL TO MOD.	LOW TO MED.	HIGH	MED.	HIGH TO MED.	LOW	1-11 (5) *221*	.2-1.1 (.7) *208*	17-3 (25 *174*
EQUALITY FORMATION		SILT, CLAY, CLAYEY SILT	5-30	45-80	10-45	5-50	LEVEL TO MOD.	LOW TO MED.	HIGH	MED.	HIGH TO MED.	LOW	2-10 (7) *118*	.2-1.1 (.7) *117*	23-3 (30 *115*
HENRY FORMATION		SAND & GRAVEL	75-90	5-15	5-10	20-120	LEVEL TO GENTLE	MED. TO HIGH	LOW	MED.	MED.	MED. TO HIGH	5-65 (28) *576*	NON-COHESIVE	—
PEORIA LOESS & ROXANA SILT		SILT (LOESS)	0-15	60-95	5-25	15-100	LEVEL TO STEEP	LOW TO MED.	HIGH	HIGH	HIGH TO MED.	LOW	3-13 (7) *244*	.4-1.6 (1.0) *220*	20-3 (26) *229*
GLASFORD FORMATION		GLACIAL TILL	15-45	30-50	20-40	15-75	MOD. TO STEEP	HIGH	MED. TO HIGH	MED.	HIGH	LOW	7-60 (23) *423*	.8-8.0 (3.0) *423*	9-25 (16 *321*
BEDROCK		SHALE SANDSTONE LIMESTONE COAL	—	—	—	—	MOD. TO STEEP	HIGH	LOW	LOW	HIGH TO MED.	LOW TO MED.	MOSTLY > 100	MOSTLY > 5.0	—

* 1-15, Range of values; (5), Average value; *370*, Number of values averaged.

The Cahokia Alluvium of the Surface Geology Map is divided into two parts in the data table. The combined alluvial fan and upland tributary portions of the Cahokia are separated from the broad alluvial deposits of the American Bottoms. The fans and upland stream deposits are mostly silt, and the American Bottoms deposits contain more clay, sand, and organic matter.

The Equality Formation, Peoria Loess and Roxana Silt, and Henry Formation units are used in both the table and map. For the purpose of compilation, sandy alluvium below the silty and clayey Cahokia deposits in the American Bottoms is included in the Henry Formation.

Engineering properties in the data table are expressed numerically or verbally. Verbal interpretations of many parameters are given to make the table more readable and usable. A supplement to the data table is included to explain verbal nterpretations with numerical values. Thus, high-, medium-, and low-bearing capcities are not just relative terms, but can be translated into numerical values or unconfined compressive strength and standard penetration test.

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*The Engineering Data Table (Table G-1); a Surface Geology Map (scale 1:24,000) and a Loess Thickness Map (scale 1:24,000) were prepared for SIMAPC's Surface Drainage Program by E.D. McKay, Illinois State Geological Survey. The combined data from the Surface Geology Map and the Loess Thickness Map is shown on Plate 3, "Basin Geology," page 25 of this report.

SUPPLEMENT TO ENGINEERING DATA TABLE

Definitions of Engineering Characteristics

. Slope

Slope is a term denoting the vertical rise in feet per 100 feet of horizontal istance predominating within each unit.

his Report	USDA	Degrees	% Slope
evel to depressional	A	0° to 1°	0 - 2
entle	B, C, D	1° to 9°	2 - 15
oderate	E	9° to 11°	15 - 20
teep	F	> 11°	20

. Engineering Properties and Classification of Surficial Deposits

1. Bearing Capacity (after Terzaghi & Peck, 1967)

Clayey Soils

his eport	Relative Strength	Field Test	Unconfined Compressive Strength Tons/sq.ft.	Standard Penetration Test, Blow Count
Low	Very soft	Easily penetrated several inches by fist	0.25	2
	Soft	Easily penetrated several inches by thumb	0.25-0.5	2-4

Med.	Medium	Can be penetrated several inches by thumb with moderate effort	0.5-1.0	4-8
	Stiff	Readily indented by thumb but penetrated only with great effort	1.0-2.0	8-15
High	Very stiff	Readily indented by thumbnail	2.0-4.0	15-30
	Hard	Indented with difficulty by thumbnail	> 4.0	> 30

2. Susceptibility to Frost Heave

Susceptibility to frost heave depends primarily upon the percentage of fine-grained particles in the surficial materials.

This Report	Corps	Type of Materials
Low	F1	sand and gravel
Medium	F2, F3	sand, silt, gravel mixtures
High	F4	silty sands and tills, silts, clays, any material with a high proportion of fins

3. Susceptibility to Erosion

Erosion is the removal of a material by wind or water. Susceptibility to erosion depends upon several factors: the slope of the ground, the cohesive strength of the materials, and the density of vegetation in the area, generally as summarized in the following table:

usceptibility to Erosion	Slope	Cohesive Strength	Vegetation Density
Low	Level	High	High
Medium	Moderate	Medium	Medium
High	Steep	Low	Low

. Hydrologic Conditions

1. Water Table

	(depth most of year)	
High to surface:	0 to 10 feet	above basement level
Medium:	10 to 15 feet	near basement level
Low:	greater than 15 feet	below basement level

2. Permeability

Permeability is the relative ease with which a material is capable of transmitting water.

This Report	cm/sec	Materials
ow	$< 10^{-5}$	silty and clayey tills, silts, clays, fine-grained organic materials
Medium	10^{-3} to 10^{-5}	fine sands, silty sands and gravels
High	$> 10^{-3}$	clean sands and gravels

SOILS ASSOCIATION DATA

appendix h

DESCRIPTION OF GENERAL SOIL ASSOCIATIONS AND DOMINANT SOILS

TABLE H-1
ESTIMATED SOIL LIMITATIONS OR SUITABILITY FOR SELECTED USES

GENERAL SOILS ASSOCIATIONS

The following is a general discussion of the soils in Planning Basins 1, 2 and 3. The discussion places emphasis on the major soil properties and their influence on particular land uses as well as their influence on water runoff. Soil limitations are shown in Table H-1.

The information is not intended to provide on-site detail. This material is of a general nature and intended for general planning purposes only. A detailed soil survey is available for the area in Jersey County and can provide more specific information. Madison and Macoupin Counties do not have a detailed soil survey and thus more specific information is not available.

. HERRICK-PIASA-DARMSTADT ASSOCIATION

ne Herrick-Piasa-Darmstadt soil association occupies nearly level and gently loping topography on the uplands. It is in the extreme northern and eastern part f the planning basins. The soils in this association formed in silty material loess) more than 5 feet thick. This association is on the broad watershed divides nd the upper portion of the drainageways. The soils in this association were ormed under grass vegetation. A large portion of the soils in this association re affected by an excessive amount of sodium salts and are referred to locally as Slick Spots" when exposed.

errick soils make up about 35 percent of the association. These dark-colored, omewhat poorly drained soils occupy nearly level slopes and somewhat elevated ositions on the landscape. They have very dark brown and very dark gray silt loam urface layers. Subsoil layers consist of mottled brownish yellow silty clay loam. nderlying material is a mottled light gray silt loam. Herrick soils have moder- tely slow permeability. Seasonal wetness is a problem. When drained, these soils re well suited to intensive cropping, but have severe limitations for most non- arm uses. Factors affecting non-farm uses include seasonal wetness, susceptibility o frost heave and shrink-swell potential.

iasa soils make up about 30 percent of the association. These moderately dark- olored, poorly drained soils occupy nearly level slope positions on the landscape. hey have very dark gray silt loam surface layers. Subsoil layers consist of rayish brown silty clay loam. Underlying material is a mottled grayish brown silt oam. Piasa soils have slow to very slow permeability. Seasonal wetness, high lkalinity, and slow to very slow permeability are problems. This soil has severe imitations for both farm and non-farm uses. Factors affecting non-farm uses in- lude wetness, high frost-heave potential, low strength, and moderate to high hrink-swell potential.

armstadt soils make up about 20 percent of the association. These light to mod- rately dark-colored, somewhat poorly drained soils occupy nearly level to sloping ositions on the landscape. They have dark grayish-brown silt loam surface layers. ubsoil layers consist of mottled brown and pale brown silty clay loam. Underlying aterial is a light gray silt loam. Darmstadt soils have slow to very slow perme- bility. Seasonal wetness, high alkalinity, erosion on sloping areas and slow to ery slow permeability are problems. This soil has severe limitations for both arm and non-farm uses. Factors affecting non-farm uses include seasonal wetness, igh frost heave potential, low strength and moderate shrink-swell potential.

inor soils are Virden, Harrison, Cowden and others. These soils make up about 15 ercent of the association. Virden and Cowden soils are poorly drained and not ffected by excessive sodium salts. The Virden soils occupy depressional areas on he landscape and are moderately slowly permeable. The Cowden soils occupy nearly evel areas and are slowly permeable. Harrison soils are moderately well-drained nd occupy low-lying knolls. They are moderately permeable.

he Herrick-Piasa-Darmstadt association is suited to farm uses but poorly suited to on-farm uses. Wetness and excessive sodium salts are the dominant problems.

This association can be considered in hydrologic soil group D/C. Surface runoff is medium. The permeability is dominantly slow.

2. DARWIN ASSOCIATION

The Darwin soil association occupies nearly level to depressional areas in the Mississippi River Valley. The major portion of this association is an area about 3 miles wide, running parallel and adjacent to the Bloomfield-Onarga soil association. The soils in this association formed in fine-textured "clayey" sediments that were transported and deposited in slack water. Native vegetation is a mixture of grasses and deciduous trees.

Darwin soils make up about 70 percent of this soil association. These dark-colored, poorly drained soils occupy nearly level to depressional areas of the association. They have very dark gray silty clay surface layers. The subsoil layers are dark gray silty clay with some yellowish brown mottling. Gray clay with a few yellowish brown mottles underlies the subsoil. Darwin soils have very slow permeability. Wetness is a severe hazard on these soils. They are subject to flooding (when not protected by levees) and ponding. These soils have severe limitations for both farm and non-farm uses. Darwin soils have high clay content, high shrink-swell potential, seasonal high water tables, and very slow permeability which are hazards to all uses.

Darwin Variant soils make up about 15 percent of this soil association. These light-colored, poorly drained soils occupy depressional areas and old sloughs within the association. They have dark grayish brown silty clay surfaces. The subsoil is mixed light gray to gray and grayish brown silty clay. Underlying material is stratified sands, silts and clays. Darwin Variant soils have very slow permeability. Wetness is a severe hazard on these soils. They are subject to flooding (when not protected by levees) and ponding. These soils have severe limitations for both farm and non-farm uses. Darwin Variant soils have high clay content, high shrink-swell potential, seasonal high water tables, and very slow permeability which are hazards to all uses.

Minor soils are Gorham and others, which make up the remaining 15 percent of the soil association. Gorham soils are dark-colored and poorly drained and are clay loam in texture. Permeability of Gorham is moderate to moderately slow. Wetness is the primary hazard on these soils. They have severe limitations for both farm and non-farm uses.

The Darwin soil association is presently used for both farm and non-farm uses. While hazards are great for both farm and non-farm uses due to wetness, limitations are somewhat more severe for most non-farm uses. Factors contributing to these severe limitations include high clay content, high shrink-swell potential, seasonal high water tables, susceptibility to flooding and ponding, and slow to very slow permeability.

This association can be considered in hydrologic soil group D. Surface runoff is slow to ponded. The permeability is slow to very slow.

WAKELAND-HAYMOND ASSOCIATION

e Wakeland-Haymond soil association occupies nearly level bottomlands along the
all streams throughout the county. This association cuts through upland soil
sociations. The soils in this association formed in predominantly silty, allu-
al material, but may include a wide range in texture, color, permeability, and
tural drainage. Native vegetation is a mixture of grasses and deciduous trees.

keland soils make up about 80 percent of the soil association. These light-
lored, somewhat poorly drained soils occupy nearly level bottomlands along the
reams, generally associated with the light-colored upland soil areas in the Plan-
ng Basins. They have dark grayish brown silt loam surfaces. The weakly devel-
ed subsoil is a dark grayish brown silt loam and is underlain by a grayish brown
brown silt loam mottled with light brownish gray and gray. Wakeland soils are
derately permeable. They are subject to flooding, when not protected by diver-
ons or levees. Periodic wetness is a problem. When drained, these soils are
ll suited to intensive cropping, but have severe limitations for most non-farm
es. Factors affecting non-farm uses include periodic flooding, ponding, and sus-
ptibility to frost heave.

ymond soils make up about 15 percent of this soil association. These light-
lored, well-drained soils occupy nearly level bottomlands along the creek. They
ve a dark grayish brown surface layer extending down to a depth of more than 24
ches. The underlying material is a dark grayish brown silt loam. Haymond soils
e moderately permeable. These soils are subject to overflow and periodic wetness
a problem. These soils are well suited to intensive cropping, but have severe
mitations for most non-farm uses. Factors affecting non-farm uses include
riodic flooding, ponding, and susceptibility to frost heave.

nor soils are Bonnie and others which make up the remaining 5 percent of the
sociation. The Bonnie soil is light-colored, and formed in silty material. These
ils are somewhat lower in elevation than the Wakeland and Haymond soils and occu-
nearly level to depressional positions. Bonnie soils are generally suited to
rm uses, except for flooding potential.

e major portion of this soil association is used for moderate to intensive crop-
ng. Flooding and wetness problems are the primary limitations for both farm and
n-farm uses.

is association can be considered in hydrologic soil group B. Surface runoff is
ow to medium. The permeability is dominantly moderate.

. BLOOMFIELD-ONARGA ASSOCIATION

e Bloomfield-Onarga soil association occupies nearly level to moderately sloping
ndy "terrace" position. This association is about 1 mile wide, running parallel
ith the bluff in what is known as the American Bottoms. The soils in this associ-
tion formed in coarse textured, sandy material that was transported and deposited

by water. Some re-working by wind is in evidence by a tendency for "duning" on areas of looser material. The native vegetation is a mixture of grasses and deciduous trees.

Bloomfield soils make up about 55 percent of the soil association. These well to somewhat excessively drained light-colored soils occupy nearly level to moderately sloping, dunes, ridged, or terrace break topography in the association. They have dark grayish brown fine sand surface layers and brown to yellowish brown fine sand subsurface layers. The subsoil consists of alternate layers of dark brown fine sand subsurface layers. The subsoil consists of alternate layers of dark brown fine sandy loam and yellowish brown fine sand. The layers of dark brown fine sandy loam range in thickness from less than 1 inch in the upper portion to more than 6 inches in the lower portion. Underlying material is a brown fine sand. Permeability of Bloomfield is moderately rapid to rapid. These soils have moderate limitations for both farm and non-farm uses. Factors creating moderate limitations include coarse texture, drouthiness, susceptibility to blowing, inherent low fertility, and rapid permeability.

Onarga soils make up about 25 percent of the soil association. These well-drained, dark-colored soils occupy nearly level to gently sloping areas in the association. They have very dark brown fine sandy loam surface layers. Subsoil layers are brown to dark yellowish brown heavy fine sandy loam. Underlying material is a yellowish brown stratified fine sand, loamy fine sand, and fine sandy loam. Permeability of Onarga soils is moderate to moderately rapid. These soils have slight to moderate limitations for both farm and non-farm uses. Some tendency for drouthiness and moderately rapid permeability contribute to moderate limitations for non-farm uses.

Minor soils are Ridgeville, Dickinson, and others which make up the remaining 20 percent of the association. Ridgeville and Dickinson soils have very dark brown fine sandy loam surface layers. The subsoil of Ridgeville soils is a dark grayish brown to grayish brown sandy loam to heavy sandy loam. Underlying material is a light brownish gray fine sand. The Dickinson soils have dark brown to dark yellowish brown fine sandy loam subsoil layers. Underlying material is dark yellowish brown fine sandy loam. Ridgeville soils are somewhat poorly drained and are moderately permeable. Dickinson soils are well drained and are moderately rapidly permeable. These soils have slight to moderate limitations for both farm and non-farm uses.

The Bloomfield-Onarga soil association is suited to and used for cropping, particularly vegetables and melons. Drouthiness and rapid permeability are the major limiting factors for both farm and non-farm uses.

5. CLINTON-KEOMAH ASSOCIATION

The Clinton-Keomah soil asociation occupies gently sloping to steep topography on the uplands. It is in a broad belt north of the Fayette-Rozetta soil association and south of the nearly level to sloping prairie soils in the basins. The soils in this association formed on silty material (loess) more than 7 feet thick, but in

ıerally thinner silty materials than the Fayette-Rozetta soil association. In
ıy respects this soil association resembles the Fayette-Rozetta soil association,
t the soils are somewhat more highly weathered and developed (higher in clay con-
ıt in the subsoil and lower in plant nutrients). Deciduous trees are the native
getative cover.

inton soils make up about 50 percent of the association. These light-colored,
derately well drained soils occupy gently sloping ridge tops and moderately slop-
g to steep side slopes. They have brown silt loam surface layers. Subsoil layers
nsist of brown or dark brown heavy silty clay loam. Underlying material is a
own silt loam. Clinton soils have moderately slow permeability. Erosion is
ight on gently sloping areas, and more severe on more sloping areas. Clinton
ils on less than 7 percent slopes are generally well suited to both farm and non-
rm uses. Limitations for these uses increase as steepness of slope increases.

omah soils make up about 30 percent of this soil association. These light-colored,
mewhat poorly drained soils occupy nearly level to sloping ridge tops, which are
latively broad areas between drainageways as well as adjacent to the upper reaches
drainageways throughout the soil association. Keomah soils have grayish brown
lt loam surface layers. Subsoil layers consist of mottled dark grayish brown
lty clay loam. Underlying material is a mottled grayish brown silt loam. Keomah
ils have moderately slow permeability. Erosion hazard is slight on gently sloping
eas and moderate on sloping areas. Keomah soils are generally well suited to farm
es but seasonal wetness causes it to be generally poorly suited to most non-farm
es.

nor soils are Hickory, Rushville, Downs and Clarksdale. These soils make up
out 20 percent of the association. Hickory soils are well drained, formed in
acial till, and are on lower slope positions on strongly sloping to steep areas
ar alluvial areas. The Rushville soils are poorly drained, slowly permeable and
e on nearly level areas within the broad ridge areas. Both Downs, well drained,
d Clarksdale, somewhat poorly drained, have dark surfaces and are in the upper-
st part of the soil association.

e Clinton-Keomah association is generally well suited to farm uses and well to
irly well suited to non-farm uses on the less sloping areas. The majority of this
sociation is being used for farm uses but some scattered housing is being devel-
ed within this area. Erosion is a severe hazard on more sloping areas when inten-
vely formed or when vegetation is removed during construction.

is association can be considered in hydrologic soil group B/C. Surface runoff is
dium to moderate. The permeability is dominantly moderate.

. SYLVAN-BOLD-FAYETTE ASSOCIATION

ıe Sylvan-Bold-Fayette soil association occupies moderately steep to very steep
pography on the uplands in a band averaging about 2 miles in width which parallels
ıe Mississippi River Bluff. The soils in the association formed in silty material

(loess) more than 7 feet thick. Native vegetative cover is predominantly deciduous trees.

Sylvan soils occupy about 30 percent of the association. Sylvan soils are mapped in a complex with the Bold soils. These light-colored, well-drained soils are on moderately steep to very steep slopes in the uplands adjacent to the Mississippi River Bluff. They have brown silt loam surface layers. Subsoil layers are brown or dark brown silty clay loam. Brown to yellowish brown, calcareous silt loam underlies the subsoil. Sylvan soils have moderate permeability. Erosion is a severe hazard due to steep slopes. Limitations for both farm and non-farm uses are severe because of steep slopes.

Bold soils make up about 30 percent of the association. They are generally mapped in a complex with the Sylvan soils. These moderately steep to very steep soils are light-colored and well-drained. Their surface layer is a yellowish brown calcareous silt loam. The subsurface layers are a light gray calcareous coarse silt loam. Bold soils are moderately permeable. Due to steepness of slope, erosion is a severe hazard. Steep slopes result in several limitations for both farm and non-farm uses.

Fayette soils make up about 37 percent of the association. These soils are light colored, well-drained and silty. They occupy moderately steep to very steep side slopes and very narrow moderately sloping ridge tops, particularly along the north boundary of the association. Their surface is a brown silt loam. Subsoil layers consist of brown or dark brown silty clay loam. Brown silt loam underlies the subsoil. Fayette soils are moderately permeable. Erosion is a severe hazard on these soils due to slope. Moderately steep to very steep slopes are a severe limitation for most farm and non-farm uses.

Minor soils are Hamburg, Hickory and others. These soils make up about 3 percent of the association. The Hamburg soils are light-colored, well to excessively draine and silty. They occupy ridge tops on the bluff, and generally have a south to west exposure. They have dark brown, calcareous, silty surface layers, overlying brown or yellowish brown, calcareous silt. The Hickory soils are in the northwest part of the association. They are light-colored, well-drained, and loamy. They occupy the lower portions of steep slopes. Permeability of Hamburg is moderately rapid, while Hickory is moderate. Steep slopes result in severe limitations for both farm and non-farm uses.

The Sylvan-Bold-Fayette soil association is poorly suited to most farm and non-farm uses. Maintaining vegetative cover such as trees, shrubs, and grass is essential to prevent further erosion on the soils in this association.

This association can be considered in hydrologic soil group B. Surface runoff is medium to rapid, depending in slope. The permeability is dominantly moderate.

FAYETTE-ROZETTA ASSOCIATION

ne Fayette-Rozetta soil association occupies gently sloping to steep topography on
e uplands. It is an area parallel with the Mississippi River Bluff and north and
st of the Sylvan-Bold-Fayette soil association. The southern portion of the
sociation has more abrupt changes in relief than the eastern part. The soils in
is association formed in silty material (loess) more than 7 feet thick. This
sociation is predominant along the drainageways. Deciduous trees are the native
egetative cover.

ayette soils make up about 55 percent of the association. These light-colored,
ell-drained soils occupy gently sloping ridge tops and moderately sloping to steep
de slopes. They have brown silt loam surface layers. Subsoil layers consist of
rown or dark brown silty clay loam. Underlying material is a brown silt loam.
ayette soils have moderate permeability. Erosion hazard is slight on gently slop-
ng areas, and more severe on more sloping areas. Fayette soils on less than 7 per-
ent slopes are generally well suited to both farm and non-farm uses. Limitations
or these uses increase as steepness of slope increases.

ozetta soils make up about 35 percent of this soil association. These light col-
red, moderately well-drained soils occupy gently sloping to moderately sloping
idge tops and areas adjacent to drainageways. These soils are predominantly on
ne relatively broad areas between drainageways and adjacent to the upper reaches
f drainageways throughout the soil association. Rozetta soils have grayish brown
o yellowish brown silt loam surface layers. Subsoil layers are a yellowish brown
ilty clay loam mottled with brownish gray in the lower part. Underlying material
s a yellowish brown silt loam mottled with brownish gray. Rozetta soils have mod-
rate permeability. Erosion hazard is slight on gently sloping areas and moderate
n moderately sloping areas. Rozetta soils are generally well suited to both farm
nd non-farm uses.

inor soils are Stronghurst, Rushville and others. These soils make up about 10
ercent of the association. Stronghurst and Rushville soils are somewhat poorly
nd poorly drained respectively. The Stronghurst soils are nearly level to gently
loping, while the Rushville soils are nearly level to depressional areas primarily
n the eastern and northern portions of the association. Both Stronghurst and
ushville are light-colored, silty soils. Permeability of Stronghurst is moderate
o moderately slow, while the permeability of Rushville is slow to very slow. Areas
f these soils tend to be relatively small in size. Slow permeability with attend-
nt drainage problems on Stronghurst and Rushville are the primary limiting factors
n these soils for both farm and non-farm uses.

he Fayette-Rozetta association is well suited to farm and non-farm uses on the
ess sloping areas. These areas are being used for building sites near cities,
illages, and highways. Water erosion is a severe hazard on more sloping areas
hen intensively farmed or when vegetation is removed during construction.

his association can be considered in hydrologic soil group B. Surface runoff is
edium. The permeability is dominantly moderate.

8. MUSCATINE-TAMA ASSOCIATION

The Muscatine-Tama soil association occupies nearly level to strongly sloping topography. This soil association is made up of dark colored soils commonly called "Prairie soils." The soils in this association formed in moderately thick to thick loess and the native vegetation is predominantly grass.

Muscatine soils make up about 60 percent of the association. These dark-colored, somewhat poorly drained soils occupy nearly level areas that are somewhat lower than areas of Tama soils. Muscatine soils have black or very dark brown silt loam. Underlying material is a mixed brown and gray silt loam. The permeability of Muscatine soils is moderate to moderately slow. Muscatine soils are generally well suited to intensive cropping. Periodic wetness may be a slight limitation when not drained. These soils have moderate limitations for most non-farm uses due to seasonal high water table, susceptibility to frost heave, and high shrink-swell in the subsoil.

Tama soils make up about 35 percent of the soil association. These dark-colored, well-drained soils occupy gently sloping to strongly sloping topography, generally somewhat higher than the associated Muscatine soils. These soils are on the crests of knolls, and ridge tops throughout the association. Tama soils have very dark brown to very dark grayish brown silt loam surface layers. Subsoil layers are a brown to dark brown silty clay loam. Underlying material is a brown to dark brown silt loam. These soils are moderately permeable. Erosion hazard is slight on gently sloping areas, and moderate on moderately and strongly sloping areas. They are generally well suited to both farm and non-farm uses on slopes less than 7 percent. Moderate limitations develop on slopes greater than 7 percent.

Minor soils include Virden, Clarksdale, Downs, and others. These soils make up the remaining 5 percent of the association. The Virden soils are dark-colored, poorly drained, nearly level to depressional soils occupying somewhat lower-lying areas than the somewhat poorly drained Ipava and Clarksdale soils. They have black silt loam or silty clay loam surface layers. Permeability of the Virden soils is moderate to moderately slow. Clarksdale and Downs soils are moderately dark-colored, somewhat poorly and moderately well to well-drained soils formed under mixed prairie and forest vegetation. These soils are commonly known as prairie-forest "transition" soils. The Clarksdale soils occupy nearly level to gently sloping areas in the prairie-forest fringe areas of the association. Downs soils are on gently sloping to strongly sloping ridge tops, drainage divides, and areas adjacent to drainageways, also in the prairie-forest fringe areas of the association, Clarksdale soils are moderately slowly permeable, while the Downs soils are moderately permeable. Seasonal high water table and ponding are limitations on Virden soils when undrained. When drained, these soils are suited to intensive cropping along with the Clarksdale soils. Erosion is a limitation on Downs soils due to sloping conditions. Virden soils have severe limitations for non-farm uses due to ponding, seasonal high water table, high susceptibility to frost heave, and moderately slow permeability. Clarksdale soils have moderate limitations for non-farm uses primarily due to seasonal high water table. Downs soils are generally well suited for both farm and non-farm uses up to slopes of 7 percent. Limitations are moderate on slopes over 7 percent.

ne Muscatine-Tama association is generally well suited and used for intensive ropping. Corn and soybeans are the dominant crops. Many fringe areas of cities nd towns are changing from farm to non-farm uses. The Tama and Downs soils genrally have few limitations for both farm and non-farm uses. The Muscatine and larksdale soils are generally well suited to farm use, but have moderate limitaions for non-farm uses. The Virden soils are well suited to farm uses when rained, but have several limitations for non-farm uses.

nis association can be considered in hydrologic soil group B. Surface runoff is low to medium. The permeability is dominantly moderate.

. MUREN-STOY-HICKORY ASSOCIATION

he Muren-Stoy-Hickory soil association occupies gently sloping to steep topography n the uplands of the headwaters of Cahokia Creek. The soils in this association ormed in silty material (loess) more than 5 feet thick. However, on the moderately teep and steep slopes, the loess is very thin or absent and the soils were formed n glacial till. This association is predominantly associated with or close to rainageways. Deciduous trees are the native vegetative cover. This association losely resembles the Fayette-Rozetta and Clinton-Keomah soil associations. The oils generally have less clay in the subsoils than the Clinton-Keomah association nd the lower subsoils are somewhat denser or more compact than the Fayette-Rozetta ssociation.

luren soils make up about 45 percent of the association. These light-colored, modrately well-drained soils occupy gently sloping ridge tops and moderately sloping o moderately steep side slopes. They have brown silt loam surface layers. The pper subsoil layers consist of brown silty clay loam. The lower subsoil layers onsist of mottled brown silty clay loam. Underlying material is a mottled brown ilt loam. Muren soils have moderate permeability. Erosion hazard is slight on entle slopes but more severe on more sloping areas. Muren soils on less than 7 ercent slopes are generally well suited to both farm and non-farm uses. Limitaions for these uses increase as steepness of slope increases.

Stoy soils make up about 30 percent of the association. These light-colored, somevhat poorly drained soils occupy nearly level and gently sloping broad ridge tops. They have dark grayish brown silt loam surface layers. The subsoil layers consist of mottled yellowish-brown silty clay loam. Underlying material is a mottled gray silt loam. Stoy soils have slow permeability. Wetness is a problem on nearly level areas and wetness and erosion are both problems on the more sloping areas of the soil. Stoy soils are moderate to severe for farm uses and generally severe for non-farm uses.

Hickory soils make up about 15 percent of the association. These light-colored, well-drained soils occupy moderately steep to steep lower side slopes adjacent principal drainageways. They have brown loam surface layers. The subsoil layers consist of brown heavy loam to clay loam. Underlying material is a brown loam to sandy loam. Hickory soils have moderate permeability. Erosion is a hazard. Hickory soils are generally poorly suited to cultivated crops and are also poorly suited to most non-farm uses. Slope is the major limitation to all uses.

Minor soils are Rushville, Blair and others. These soils make up about 10 percent of the association. Rushville soils are poorly drained and slowly permeable. They are on nearly level areas to depressional areas. Blair soils are somewhat poorly drained and are on sloping areas in and around drainageways.

The Muren-Stoy-Hickory association is generally suited to farm uses and well to poorly suited to most non-farm uses. Slow permeability and seasonal wetness are limitations to use on Stoy soils. Water erosion is a severe hazard on more sloping areas.

This association can be considered in hydrologic soil group C. Surface runoff is medium. The permeability is dominantly moderately slow.

Table H-1
ESTIMATED SOIL LIMITATIONS OR SUITABILITY FOR SELECTED USES[a]

Soil Associations and Dominant Soils	Soil Limitations For:											
					Pond Sites		Recreation			Suitability as a Source of:		
	Building Sites	Septic Tank Filter Field	Sewage Lagoons	Location of Streets & Highways	Reservoir Area	Embankment Material	Camping & Picnic Area	Playgrounds	Intensive Cropping	Topsoil	Fill Material	Drainage Limitations[b]
1. HERRICK-PIASA-DARMSTADT												
Herrick	Severe 2,13,14	Severe 2,4	Slight	Severe 13,14	Favorable	Favorable	Moderate 2	Moderate 2	Moderate 2,4	Fair 25	Poor 13,14	Moderate 2,4,13
Piasa	Severe 1,13,14	Severe 1,4	Slight	Severe 13,14	Favorable	13,15	Severe 1,21	Severe 1,3	Moderate 1,4	Poor 1,25	Poor 1,13,14	Moderate 1,4
Darmstadt	Severe 2,13	Severe 2,4	Slight	Severe 13,14,15	Favorable	13,15	Severe 2,4,21	Severe 2,4,19	Severe 2,4,19	Fair 25	Poor 13,14	Moderate 2,4
2. DARWIN												
Darwin	Severe 1,3,4,16	Severe 1,3,4,16	Severe 3,17	Severe 3,13,14,16	1,3,10	1,3,14,16	Severe 1,3,4,16,21	Severe 1,3,4,16,21	Severe 1,3,4	Poor 1,3,16	Poor 1,3,16	Severe 1,3,4
Darwin Variant	Severe 1,3	Severe 1,3	Severe 3	Severe 1,3,13	1,3,7	1,3	Severe 1,3,4,16,21	Severe 1,3,4,16,21	Severe 1,3,4	Poor 1,3,16	Poor 1,3,16	Severe 1,3,4
3. WAKELAND-HAYMOND												
Wakeland	Severe 3,4,13	Severe 2,3	Severe 3,6	Severe 2,3	3,6	3,15	Severe 2,3	Severe 3	Moderate 3	Good	Poor 2,3	Moderate 2,3
Haymond	Severe 3,6,13	Severe 3	Severe 3,6	Severe 3,13	3,6	3,15	Moderate 3	Severe 3	Slight	Good	Good 3	Slight
4. BLOOMFIELD-ONARGA												
Bloomfield	Moderate 10-9,11,18,19,20	Moderate 10-9,18,20,22	Severe 18,20,22	Moderate 10-9,11,12,18,22	18,20	15,18,20	Moderate 10-9,18,19,23	Severe 11,18,19,20,23	Severe 11,18,19,20,23	Poor 18	Good	Severe 19,20
Onarga	Moderate 7,18,22	Slight-Moderate 7,10-9,22	Severe 7,22	Moderate 11,13,18	7,18	7,15,18	Slight	Slight	Moderate-Severe 7,18,19	Good-Fair 18	Fair-Good	Slight-Moderate 7,19
5. CLINTON-KEOMAH												
Clinton	Moderate-Severe 10,9,8,16	Moderate-Severe 10,9,8,5	Slight-Severe 10,9,8,22	Severe 11,12,14,15	Moderate 9,8	11,12,15	Slight-Severe 10,9,8	Slight-Severe 10,9,8	Moderate-Severe 10,9,8,11	Fair 25	Poor 13,14,15	Slight
Keomah	Moderate 2,13	Severe 2,4	Slight	Moderate 2,4,13,14	Favorable	Favorable	Moderate 2	Moderate 2	Moderate 5,10	Fair 25	Poor 2,13,14	Moderate 2
6. SYLVAN-BOLD-FAYETTE												
Sylvan	Severe 8,11,15	Severe 8	Severe 8	Severe 8,11,12,15	7	15	Severe 8	Severe 8	Severe 8,11	Fair 8,12	Poor 15	Slight
Bold	Severe 8,11,15	Severe 8	Severe 8	Severe 8,11,12,15	7	15	Severe 8	Severe 8	Severe 8,11	Fair 8,12	Poor 15	Slight
Fayette	Severe 8,11,15	Severe 8	Severe 8	Severe 8,11,12,15	6	15	Severe 8	Severe 8	Severe 8,11	Fair 8	Fair 15	Slight

Table H-1 (continued)

	Soil Limitations For:											
					Pond Sites		Recreation			Suitability as a Source of:		
Soil Associations and Dominant Soils	Building Sites	Septic Tank Filter Field	Sewage Lagoons	Location of Streets & Highways	Reservoir Area	Embankment Material	Camping & Picnic Area	Playgrounds	Intensive Cropping	Topsoil	Material	Drainage Limitations[b]
7. FAYETTE-ROZETTA												
Fayette	Moderate-Severe 9-8	Moderate-Severe 9-8	Moderate-Severe 6,9-8	Moderate-Severe 8,9,11, 12,15	6,9-8	15	Moderate 9-8	Moderate-Severe 9-8	Moderate-Severe 8,9,11	Fair-Good 8,9	Fair 15	Slight
Rozetta	Slight-Moderate 10-9	Slight Moderate 10-9	Moderate 6	Moderate 11,12,15	6	15	Slight	Moderate 9	Moderate 9,11	Good 9	Fair 15	Slight
8. MUSCATINE-TAMA												
Muscatine	Moderate 2,5,13	Moderate 2,5	Moderate 2,17	Moderate 2,3,13	Favorable	15,17	Moderate 2	Moderate 2	Slight	Good	Poor 2,3	Moderate 2
Tama	Moderate 9-8,11	Slight-Moderate 10-9	Moderate 10-9,6	Moderate 10-9,11, 15	6	15	Slight	Moderate 10-9	Moderate 10-9,11	Good	Fair 15	Slight
9. MUREN-STOY-HICKORY												
Muren	Slight-Moderate 26	Severe 4	Slight-Moderate 10,9,8	Severe 13,15	Favorable	15,11	Slight-Moderate 26,4	Moderate 4,26	Moderate 11	Fair 25	Poor 13	Slight
Stoy	Moderate 15	Severe 2,4	Moderate 2	Moderate 2,13,15	Favorable	15	Moderate 2	Moderate 2	Moderate	2,4	Poor 13	Moderate 2,4
Hickory	Moderate-Severe 9,8	Severe 8	Severe 8	Moderate-Severe 8,9,13, 14	Favorable	Favorable	Moderate-Severe 8	Severe 8	Severe 8	Fair-Poor 8,16	Poor 14	Slight

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[a] For explanation of numbers used in this table, see Limiting Soil Properties listed below:

1. Seasonal high water table at or near the surface.
2. Seasonal high water table 1 to 3 feet below the surface.
3. Flooding or ponding hazard.
4. Very slowly to slowly permeable (0.063 to 0.20 in./hr.).
5. Moderately slowly to moderately permeable (0.20 to 2.00 in./hr.).
6. Moderately permeable (0.63 to 2.00 in./hr.).
7. Rapidly permeable (6.30 to 20.0 in./hr.) below 3 feet.
8. Strongly sloping to very steep (7 to more than 30 percent).
9. Moderately sloping (4 to 7 percent).
10. Nearly level to gently sloping (0 to 4 percent).
11. Erosion hazard (water and/or wind).
12. Many cuts and fills in construction.
13. High susceptibility to frost heave.
14. Moderate to high shrink-swell potential.
15. Fair stability, compaction, and resistance to piping below 3 feet.
16. High clay content.
17. High organic matter content.
18. High sand content.
19. Drouthy.
20. Rapidly permeable (6.30 to 20.0 in./hr.).
21. Slippery and sticky when wet and slow to dry out.
22. Hazard of contaminating nearby underground water supply.
23. Poor to fair response to fertilization.
24. Sinkholes.
25. Thin layer.
26. Seasonal high water table 3 to 6 feet below the surface.

[b] A rating of "slight" indicates that drainage is generally not needed.

Source: Soil Conservation Service.

EROSION AND SEDIMENTATION DATA

appendix i

SOIL EROSION

SEDIMENT YIELD

EROSION CONTROL MEASURES

ROSION AND SEDIMENTATION ANALYSIS

e following summary explains the methods of analysis and the results of an in-
stigation of erosion and sedimentation with respect to the major drainage system
the Planning Basins. The study was completed in cooperation with representatives
the USDA Soil Conservation Service and the Madison and St. Clair County Soil and
ter Conservation Districts.

osion Rate

il loss, related to sheet and rill erosion, is evaluated in tons per acre per
ar by an equation known as the Universal Soil Loss Equation (USLE). Developed
the Agricultural Research Service, the USLE provides a method for computing the
ount of erosion occurring in a watershed.

e Universal Soil Loss Equation is as follows: A = RKLSCP.

is the average annual soil loss in tons per acre per year. A is not the sediment
eld.

is the rainfall erosion factor. It is the number of erosion-index units in a
rmal year's rain. The energy of moving water detaches and transports soil
aterials. The energy-intensity (EI) parameter measures total raindrop energy of a
torm and its relation to the maximum 30-minute intensity. Soil losses are linear-
proportional to the number of EI units. The EI values are summed to obtain an
nnual rainfall-erosivity index for a given location. This annual index is labeled
e R factor and has been computed for the area east of the Rocky Mountains.

is the soil erodibility factor. It is a measure of the rate at which a partic-
lar type of soil will erode. The fact that different kinds of soil erode at dif-
erent rates when other factors such as climate and soil cover remain constant, is
epresented by the K factor. The most significant soil characteristics affecting
oil erodibility are texture, organic matter, soil structure and permeability. The
values have been assigned to the named kinds of soil and may be obtained from the
oil Conservation Service (SCS).

is the length of slope factor. Length of slope can be an important factor in the
quation. The longer the slope, the more susceptible it is to erosion. Slope
ength is defined as the distance from the point of origin of overland flow to the
oint where runoff enters a well-defined channel which may be part of a drainage
etwork or a constructed channel such as a terrace or diversion.

is the steepness of the slope factor. Accurate slope steepness data concerning a
ield or portion of a field under consideration is necessary for proper application

of the soil loss equation. Significant differences in predicted soil losses will occur between different percent slopes which fall within the same slope groups used for soil survey. It is necessary, therefore, to determine accurately the percent of slope to be used. For convenience in the field application of the equation, length and steepness of the slope are combined into a single topographic factor, LS.

C is the plant cover or cropping management factor. The factor value is determined by the effect of cover. The erosion equation, as used for cropland, uses established factor relationships to estimate a basic soil loss that is determined by the soil properties, topographic features, certain conservation practices, and rainfall patterns for a specific field. The basic soil loss is the rate at which the field would erode if it were continuously in tilled fallow. The C factor indicates the percentage of this potential soil loss that would occur if the surface were partially protected by some particular combination of cover and management. C factor values have been computed for various land uses including woodland, cropland and idle land.

P is the erosion control practice factor. This factor accounts for control practices that reduce the erosion potential of the runoff by their influence on drainage patterns, runoff concentration, and runoff velocity. Practices for which P factors have been established are contouring, contour strip cropping and contour irrigated features.

The USLE was used in selected upland watersheds within the Piasa Creek, Wood River and Cahokia Creek Drainage Basins (PIWOCA). By calculating the amount of erosion in particular watersheds, it was possible to project the amount of erosion throughout the uplands portion of PIWOCA and, eventually, the amount of sediment yield to the various streams and creeks.

In order to utilize the USLE in the PIWOCA, two basic steps were employed. First, three watersheds representative of the entire uplands portion of the Planning Basins were selected. Within each watershed, sample areas of 160 acres were chose for application of the USLE. These sample areas, comprising approximately 10 percent of the land in the watersheds, are representative of the various land uses and physical conditions found in the uplands.

Secondly, an intensive field survey of the various sample areas was accomplished. Field surveys were conducted in cooperation with the District Conservationist, of the Soil Conservation Service (SCS), in Madison County. Information collected during the surveys included land use, land management practices, degree and type of vegetative cover, erosion problems and the degree of channelization. In conjunctio with the field surveys, detailed air photos were used to gather additional data and reinforce the land use data. Data collected from the air photos included soil types, length and percent of slopes, and land uses. This information along with information obtained from the field survey was then inserted into the USLE.

esults derived from utilizing the USLE in the three watersheds can be seen in ble I-1. Table I-1 represents composite data by land use for the three water- eds. Information for each land use includes: number of acres, percent of total mple areas, erosion rate in tons per acre per year, and the total amount of osion.

Table I-1
COMPOSITE DATA ON THREE WATERSHEDS
IN PIWOCA PLANNING BASINS

nd Use	Acres	% of Total Area	Gross Erosion (tons) Per Acre Per Year	Gross Erosion (tons) Total
ban	615	31	.9	368
odland	279	14	4.9	1,372
griculture	751	38	19.3	14,498
asture	343	17	8.8	0
ater	12	-	0	-
otal	2,000	100	8.1	16,238

ource: SCS and SIMAPC field survey results.

n order to apply the erosion rates in the PIWOCA, it was necessary to first know he breakdown by land use throughout each watershed. Land use figures for the atersheds were determined from a combination of field surveys and the use of air hotos. Sub-sheds within each watershed were broken down into five basic land uses-- rban, woodland, agriculture, pasture and water. The total number of acres for each and use within a sub-shed was then multiplied by the erosion rates for the corresponding land uses. By adding up the total amount of erosion contributed by each land use, a total erosion figure for the entire watershed was obtained.

Results of the erosion study for Piasa Creek, Wood River and Cahokia Creek watersheds are presented in Tables I-2, I-3 and I-4 respectively. Data is presented by the various land uses existing throughout the watersheds. Information for each land se includes: number of acres, percent of total watershed, erosion rate in tons per acre per year, and the total amount of erosion. In addition, total figures are given for the entire watershed and for that portion of the watershed located in Madison County. The total figures include: number of acres, percent of total watershed (for Madison County), average erosion rate in tons per acre per year, total erosion, percent sediment yield to streams, average sediment yield in tons per acre per year, and total sediment yield.

Sediment Yield

Sediment yield is dependent upon the gross erosion in the watershed and the transport of the eroded material out of the watershed. Only a portion of the material eroded from upland areas in each watershed is carried out of the watershed. Varying proportions of the eroded materials are deposited at the base of slopes, in swales, in natural or artificial lakes, and in channels within the watershed.

Sediment delivery rates were computed for each of the sub-sheds in the three watersheds. From this data, an average sediment yield was calculated for the entire watershed (see Tables I-2, I-3 and I-4). Guidelines for determining sediment delivery rates were obtained from Sedimentation, SCS National Engineering Handbook, a publication prepared by the United States Department of Agriculture. Major factors which influence the yield of a watershed include: the size of its drainage area, degree of channelization, topography, soils and cover conditions.

Watershed Size - The larger the drainage area in a given physiographic area, the larger the sediment yield, Generally, in a given physiographic area, the rate of sediment yield per unit drainage decreases as the size of drainage increases. The greater range of rates and the higher rates in small watersheds are mainly caused by the shorter distances for sediment to be transported and their more homogeneous land use. In large watersheds, the distance of sediment transport to downstream points being greater, the opportunities for deposition en route are more numerous.

Topography - The shape of the land surface is an inherent feature of the physiographic section in which the watershed is located. Many of the problems of soil conservation depend on the situation in the individual watershed, especially what proportions of the area are upland, valley slope, flood plain, or include special features such as sink holes or alluvial fans. Slope is a major factor affecting rates of on-site erosion, and watershed topography is an important factor affecting the delivery of eroded material.

Channel Density - The efficiency of a stream system to transport sediment out of a watershed is related to the degree of channelization. A watershed with a high channel density (total length of channel per unit of area) will have the most thorough water runoff and the most rapid and complete transportation of sediment from the area.

Soils and Cover Conditions - Soils and cover are important factors influencing sediment yields from watersheds. The more erodible the soil and sparser the vegetation, the higher the sediment yield, all others conditions being equal. The

Table I-2
EROSION RATE BY LAND USE FOR PIASA CREEK WATERSHED

			Soil Erosion In Tons Per Year			Sediment Yield In Tons Per Year	
and Use	Acres	% of Total Area	Per A.	Total	% Sediment Yield to Streams	Per A.	Total
rban	1,611	2	.6	967	-	-	-
oodland	14,488	22	4.9	70,991	-	-	-
griculture	43,116	64	19.3	832,139	-	-	-
asture	8,020	12	8.8	70,576	-	-	-
otal	67,235	100	14.5	974,673	31	4.5	302,148
adison Co. Portion Only	13,616	20	13.3	180,881	35	4.7	63,308

ource: SCS and SIMAPC field survey results.

Table I-3
EROSION RATE BY LAND USE FOR WOOD RIVER WATERSHED

			Soil Erosion In Tons Per Year			Sediment Yield In Tons Per Year	
and Use	Acres	% of Total Area	Per A.	Total	% Sediment Yield to Streams	Per A.	Total
rban	5,766	7	.6	3,460	-	-	-
oodland	17,530	22	4.9	85,897	-	-	-
griculture	47,978	61	19.3	925,975	-	-	-
asture	7,608	10	8.8	66,950	-	-	-
Total	78,882	100	13.7	1,082,282	28	3.8	303,038
adison Co. Portion Only	42,801	54	13.1	559,842	32	4.2	179,149

Source: SCS and SIMAPC field survey results.

Table I-4
EROSION RATE BY LAND USE
FOR CAHOKIA CREEK WATERSHED

Land Use	Acres	% of Total Area	Soil Erosion In Tons Per Year		% Sediment Yield to Streams	Sediment Yield In Tons Per Year	
			Per A.	Total		Per A.	Total
Urban	7,690	5	.6	4,614	-	-	-
Woodland	29,727	17	4.9	145,662	-	-	-
Agriculture	122,865	72	19.3	2,371,294	-	-	-
Pasture	10,098	6	8.8	88,862	-	-	-
Water	562	0	0	0	-	-	-
Total	170,942	100	15.3	2,610,432	32	4.9	835,338
Madison Co. Portion Only	86,936	51	15.4	1,342,350	35	5.4	469,823

Source: SCS and SIMAPC field survey results.

evaluation of sediment yields from watersheds of variable soils and mixed cover is accomplished by the use of a procedure such as the soil-loss equation.

Land Use - The land use is determined to some degree by the type of soil. In turn, the land use determines to a large degree the type of cover. Heavily urbanized areas, with a large percentage of the ground covered by pavement and structures, will contribute little sediment. Increased runoff resulting from urbanization, however, may increase erosion problems downstream. Agricultural land with the broad area involved has the potential to produce large amounts of sediment. Proper farming techniques, however, can adequately control erosion problems.

Erosion Control Measures

Tables I-2, I-3, and I-4 depict the serious erosion problem which exists in the three watersheds. The vast amount of soil erosion removes valuable topsoil from farms; leaves gaping scars in landscapes; undermines houses, roads and bridges; and contributes to flooding. Damage is inflicted at the scene where soil is roded, where it is washed downstream, and where sediment remains suspended or omes to rest.

he causes of urban soil erosion differ considerably from the causes of non-urban rosion. In non-urban areas, soil erosion primarily occurs during crop management nd other farming activities. In urban areas, the primary sources of erosion are ecently developed areas and areas currently undergoing development. Therefore, here is no one set of erosion control measures applicable to all situations. nstead, there is a multitude of available erosion control measures which must be arefully related to the specific site characteristics.

able I-5 presents the primary measures for controlling erosion. Along with each easure is its definition, statement of purpose, where it is generally applicable, nd a brief description of its specifications. Because a variety of methods can e used to control erosion, each method proposed should be evaluated for its ffectiveness in the given area. Each measure sould be carefully related to site haracteristics and intensity of land use and generally all applicable measures hould be used.

Table I-5
EROSION CONTROL MEASURES

Method or Measure	Definition	Purpose	Where Applicable	Specifications
Conservation Cropping System	Growing crops in combination with management measures like rotation	Improve physical condition of soil, and protect it from erosion	On all croplands	Control soil loss by establishment o strip cropping, terracing, contourin etc.
Conservation Tillage	Limiting farming operations to essentials	Retard deterioration of soil, i.e., erosion	All croplands	Planting with soil disturbance only at seed row; a protective cover of crop residue is left on the surface for erosion control
Contour Farming	Cultivating parallel to contour	To reduce soil and water losses	Sloping cropland	Guidelines laid out on contour with maximum deviation not to exceed 2 percent
Contouring Orchards	Planting orchards so all farming operations are on contour	Reduces soil and water losses	Sloping land, especially where cover is not established	Guidelines laid out on contours with maximum deviation not to exceed 1-2 percent depending on drainage character of soil
Cover and Green Manure Crop	Crop of close-growing grasses, legumes, etc., used for seasonal soil protection	Provides vegetative cover for erosion control during periods when major crops do not	Croplands, certain recreation and wildlife lands, orchards, etc.	Following harvest, the seed bed is prepared according to type of cultivation being followed
Critical Area Planting	Planting trees, shrubs, grasses, etc., on sediment producing highly erodible or eroded areas	Stabilize soil, reduce damages from sediment and runoff	On sediment-producing, highly erodible or eroded areas such as dams, dikes, road cuts and construction sites	Prepare seed bed according to condition of the site and type of vegetative cover to be established
Crop Residue Use	Leaving plant residues to protect against erosion	Conserve moisture, increase infiltration and reduce soil losses	On cultivated land where adequate residue is produced	Leave plant residues on the surface or incorporated in the surface until planting time for the next crop
Debris Basin	Barrier or dam across waterway to form sediment basin	Preserves capacity of reservoirs, ditches, etc., by trapping sediment	Where physical conditions or land ownership preclude treatment of sediment source or where basin offers best solution	Capacity must be equal to expected volume of sediment to be trapped or if periodically removed, the capacit can be reduced proportionately
Diversion	A channel with supporting ridge on lower side constructed across a slope	To divert water from areas where it is in excess, to sites where it can be used or disposed of at non-erosive velocities	Where runoff from higher areas is damaging land (erosion) or where water is wanted in another area	Location of a diversion and outlet must be in compliance with state drainage and water laws and by outlet conditions, topography, land use necessary cultural operations, soil type and length of slope
Drainage, Field Ditch	A shallow graded ditch for collecting water within a field, usually with flat side slopes for ease of crossing	To drain basins or depressional areas or intercept excess runoff such as sheet flow from land surfaces	Sites that are flat and have soils of low permeability, depressions, receive excess runoff from uplands, etc.	Surface field ditches must be planned as integral part of a drainage system for the field served shall collect and remove water to an outlet with continuity and without ponding; they should be as straight as topography and property boundarie permit
Drainage, Land Grading	Reshaping of surface to be drained by grading to planned grades	Improves surface drainage, more effective use distribution of rainfall, etc.	On land where depressions, mounds, old terraces, etc., prevent adequate drainage	Designed slope and dimension limitations shall be those found suitable for the particular site conditions, conservation system or land use to be applied
Floodwater Retarding Structure	A structure for temporary storage of floodwater and for its controlled release	To reduce flood damages and erosion downstream by controlling the release rate of excess floodwater	Sites at which the geologic and soils conditions are satisfactory for the development of a reservoir	Inasmuch as the design criteria for this measure are so varied and numerous, it is recommended that only an engineer or other qualified person undertake its design
Grade Stabilization Structure	A structure to stabilize the grade or to control head cutting into channels	To prevent the formation or advance of gullies	Where the concentration and flow velocity are such that structures are required to stabilize the grade in channels	Inasmuch as the design criteria for this measure are so varied and numerous, it is recommended that onl an engineer or other qualified perso undertake its design
Grassed Waterway or Outlet	A natural or constructed waterway established in vegetation suitable to safe disposal of runoff	Dispose of excess surface water without damage by erosion or flooding	At sites where added vegetation alone will control erosion from concentrated flows	Design for ten-year frequency storm with temporary dike protection to develop vegetative cover
Heavy Use Area Protection	Protecting heavily used areas by establishing vegetative cover or surfacing with suitable materials	To stabilize urban, recreational or other areas subjected to sustained use by people, animals, or vehicles	On urban and recreation lands that require special treatment to protect the area from erosion	If the area use will permit sufficie plant covers to prevent erosion, a vegetative cover of various types may be used; however, if the area is to be paved, the site must be prepared and surfacing laid within recommended engineering practices

Table I-5 (continued)

thod or Measure	Definition	Purpose	Where Applicable	Specifications
vestock clusion ncing	Excluding livestock from any area where grazing is harmful	To maintain adequate cover for soil protection	Where desired vegetative cover, soil hydrologic values, or other values such as aesthetic or recreational are prevented or damaged by livestock	Establish any permanent fence properly braced and capable of turning livestock
nimization of ripped Areas	Minimizing the areas stripped of vegetation during construction	To reduce the generation of sediment	On all sites undergoing construction, especially those where there are large areas stripped of vegetation at any one time	Careful programming of a development may enable the developer to reduce the area stripped of vegetation at one time
lching	Applying plant residues or other suitable materials not produced on the site to the soil's surface	To conserve moisture, prevent surface compaction, reduce runoff and erosion	On sites subject to severe wind or water erosion	Straw, hay or other suitable commercial mulch should be applied at 2 tons of air-dry material per acre or according to manufacturer's direction at anytime soil and site conditions are suitable for spreading and anchoring
creation Area abilization	Stabilizing areas subject to heavy recreation usage by surfacing with suitable materials	To stabilize an area against erosion for sustained heavy use by people, animals, or vehicles	On recreation areas, such as parking lots, tennis courts, go-cart tracks and service areas, where physical conditions and prolonged use, etc., make vegetative cover impractical	Provisions must be made for surface and subsurface drainage as needed and for disposal of runoff without erosion; all paving and site preparation must follow good engineering practices
eded Areas otected by tting	Laying matting over recently seeded areas	To stabilize the surface of the soil and to prevent erosion during the establishment of vegetation	Particularly on steep slopes and for the protection of swales and channels to be vegetated	Choose either a mesh matting where no mulching is required or a blanket-type where mulching effect is required
ream Bank otection	Stabilizing and protecting banks against scour and erosion	Prevents loss of land, damage to roads and buildings, maintains capacity of channel, controls channel meandering	Applies to any natural or excavated channel where banks are subject to erosion	Since each reach of channel is unique, measures for protection must be according to a plan and adopted to the specific site. Because of the numerous techniques available, further detail will not be provided here
rip Cropping, ontour	Growing crops in systematic arrangement of bonds on the contour	To reduce soil erosion and provide for runoff control	On sloping cropland where topography is sufficiently uniform to permit farming operations on the contour	Planting of crops and tillage operations are parallel to strip boundaries which should be laid out on the contour with an allowable deviation of 2 percent, or 3 percent for short distances toward grass waterways or to adjust for ridges; widths of strips decrease with increased slope; steep and waterway areas should be left in grass
rip Cropping, ield	Growing crops in systematic arrangement of bonds across the general slope of the land	To help control erosion and runoff on sloping cropland where contour strip cropping is not practical	On sloping cropland where irregular slopes make contour strip cropping not feasible	Planting of crops and tillage operations are parallel to strip boundaries which should be laid out parallel to contour with an allowable deviation of 2 or 3 percent for short distances toward grass waterways or to adjust for ridges; widths of strips decrease with increased slope; steep and waterway areas should be left in grass
emporary Roads n Construction ites	Where possible, using two roads for construction traffic; one for use in dry conditions; the other incorporating measures for wet conditions	To reduce the amount of erosion resulting from the constant use of a construction road	On all construction sites, but steep slopes and highly erodible soils are particularly vulnerable	Temporary roadways should be carefully graded to drain transversely
errace Gradient	Earth embankment or ridge and channel constructed across the slope at a suitable spacing and with an acceptable grade	To reduce erosion damage by intercepting surface runoff and conducting it to a stable outlet at a non-erosive velocity	Limited to sloping cropland having a water erosion problem and areas with soils capable of absorbing and storing extra water without crop damage	Should not be constructed on soils that are too stony, steep or shallow to permit practical and economic installation; the topography must allow farmable terrace construction and grass backslopes must be provided where slope exceeds 10 percent
ree Planting	Planting tree seedlings or cuttings	To establish or reinforce a stand of trees for conservation of soil and moisture	In open fields, thin woodlands and amid less desirable tree species, where erosion control or watershed protection is needed	Species should be selected according to site conditions effect wanted produced; the site must be prepared in accordance to species' needs and undesired species removed or controlled

ote: This table adapted from: Technical Guide, Section IV, Standards and Specifications, Madison County Soil and Water Conservation District; Edwardsville, Illinois; revised as of March, 1975.

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PLATE 4

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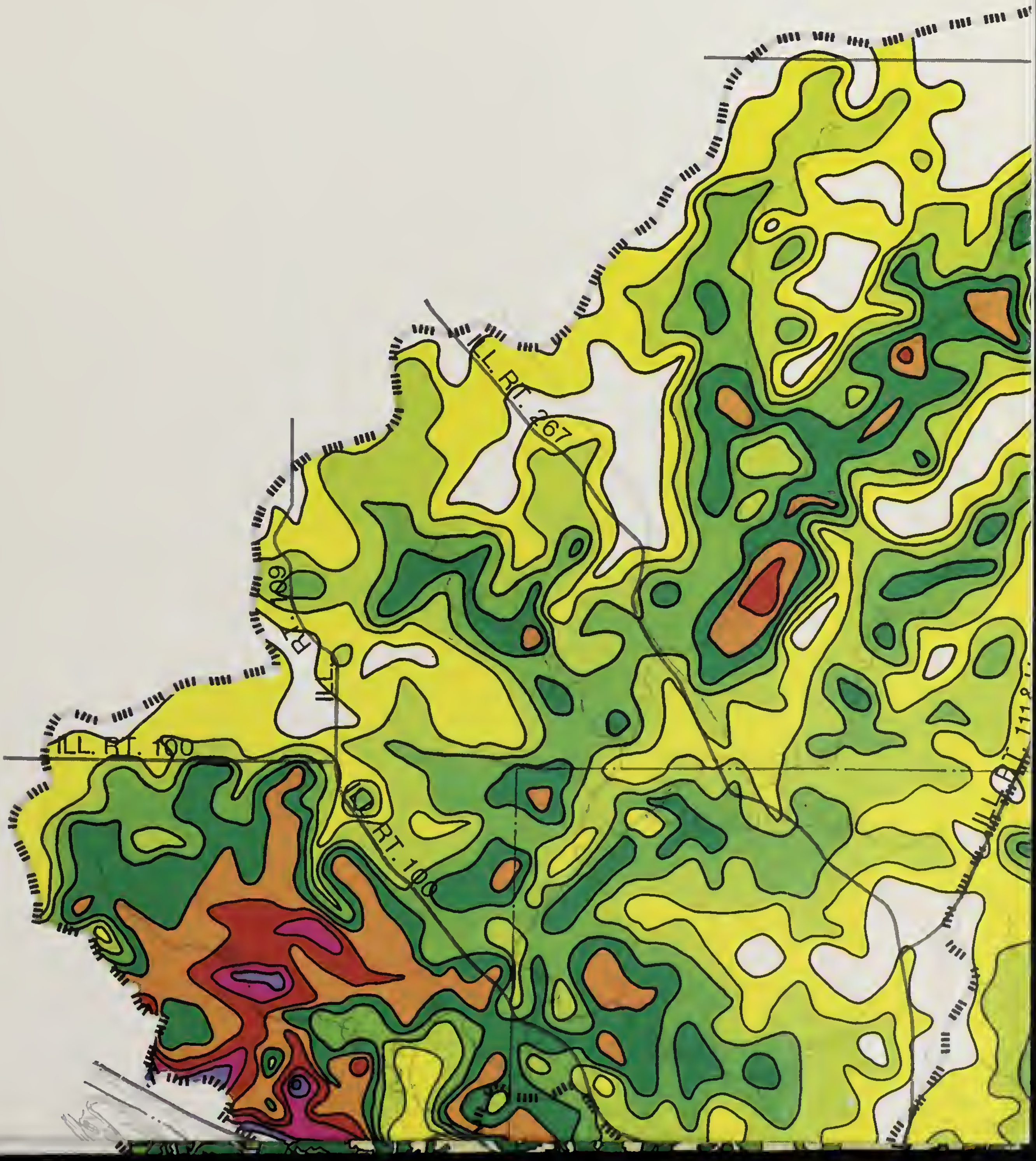

PLATE 4

BASIN TOPOGRAPHY

PIASA CREEK, WOOD RIVER AND CAHOKIA CREEK PLANNING BASINS

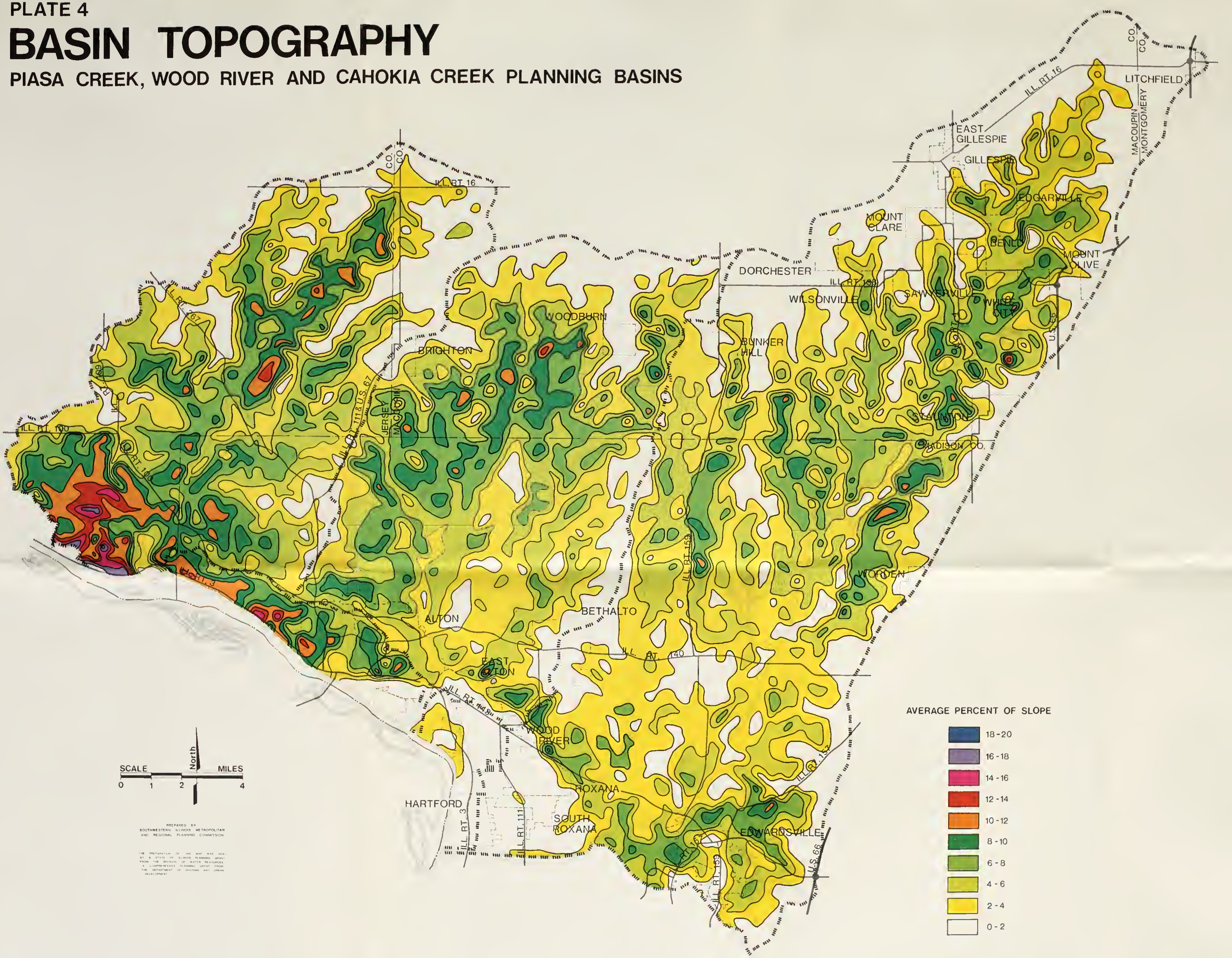

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PLATE 10

EXISTING LAND

PIASA CREEK, WOOD RIVER AND CA

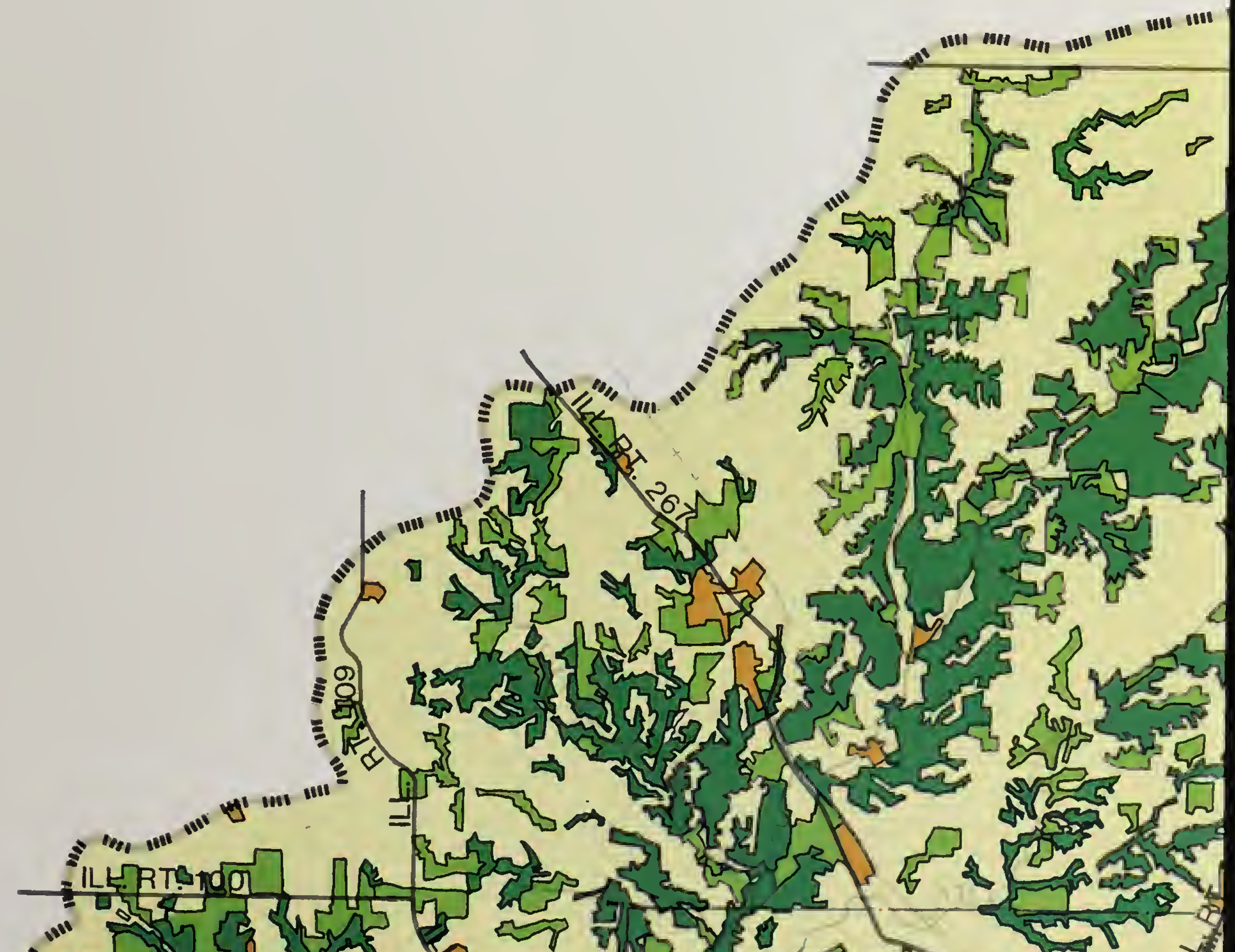

PLATE 10

EXISTING LAND USE

PIASA CREEK, WOOD RIVER AND CAHOKIA CREEK PLANNING BASINS

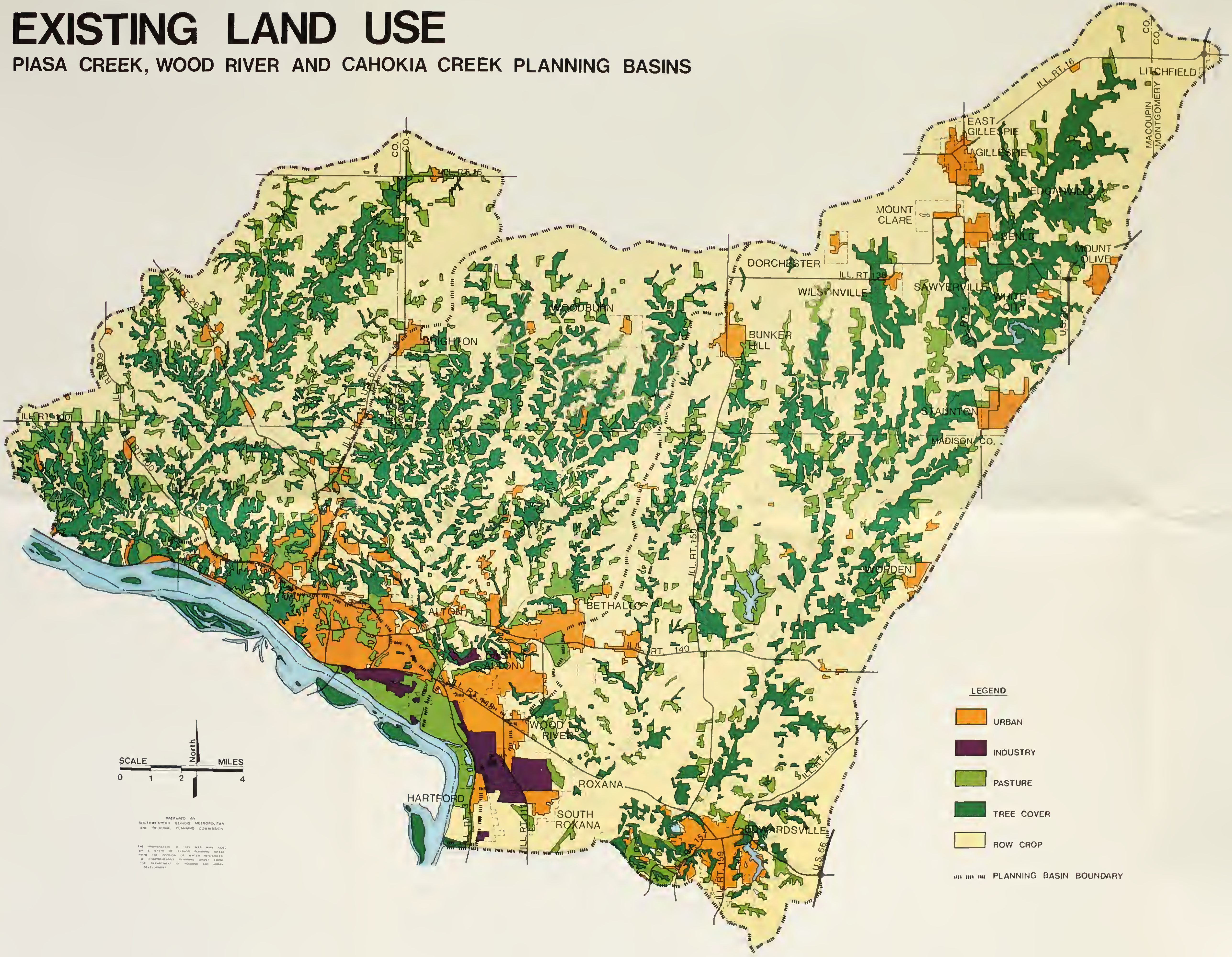

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PLATE 11

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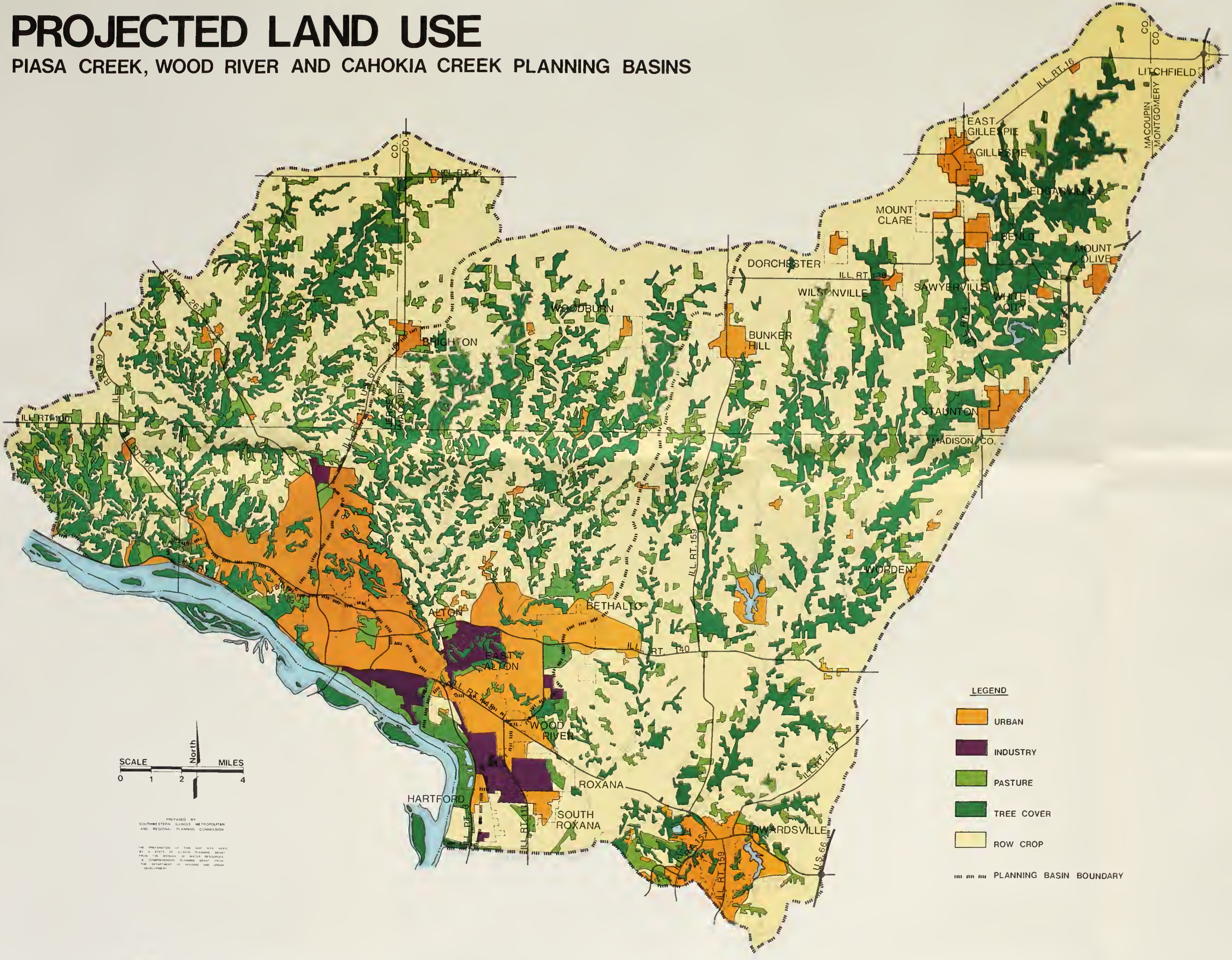
PLATE 11

PROJECTED LAND USE

PIASA CREEK, WOOD RIVER AND CAHOKIA CREEK PLANNING BASINS



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